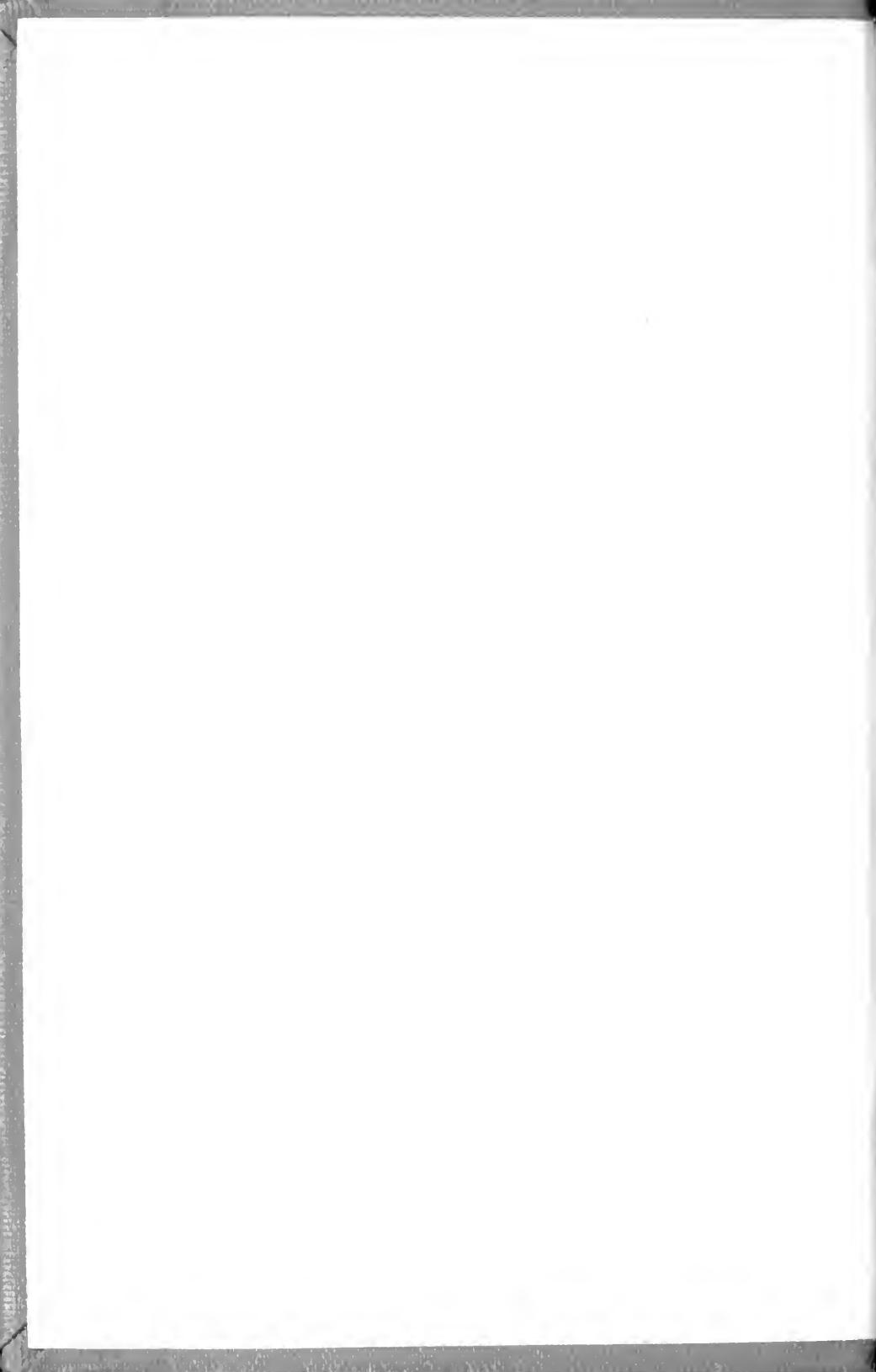


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# INTUBATION OF THE LARYNX

BY

F. E. WAXHAM, M.D.,

PROFESSOR OF OTOLARYNGOLOGY, COLLEGE OF  
PHYSICIANS AND SURGEONS OF CHICAGO; CLINICAL PRO-  
FESSOR OF LARYNGOLOGY AND RHINOLOGY,  
CHICAGO OPHTHALMIC COLLEGE.

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J. N. Henderson M.D.  
Toronto July 23/89

TO

DR. J. O'DWYER.

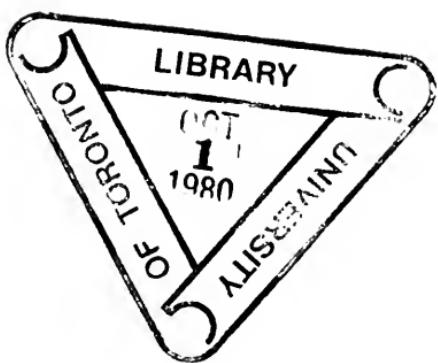
THIS SMALL VOLUME IS DEDICATED

AS A TRIBUTE TO HIS GENIUS AND UNTIRING PERSEVERANCE,

AND

AS A TOKEN OF HIGHEST REGARD BY

THE AUTHOR.



## P R E F A C E.

Few operations in the history of medicine have excited more wide-spread interest than intubation of the larynx, and, like all other new operations, it has met with opposition. It has, however, fulfilled the expectation of its advocates, and rapidly, yet surely won its way into favor, until, even now, it fairly rivals the older operation of tracheotomy.

To Dr. Bouchut, of Paris, we are indebted for the idea of relieving stenosis of the larynx by a tube introduced by way of the mouth.

To Dr. O'Dwyer, of New York, belongs the great, the imperishable honor of reviving the operation, and by his ingenuity so modifying the instruments as to make them of practical utility. Mine has been the lesser honor of assisting in the development of the operation, and of first introducing it generally into private practice.

Few can appreciate the risks and dangers that were encountered in introducing this operation into private practice. Several times my life was threat-

ened for "putting a plug in a child's throat." On one occasion I was obliged to beat a hasty retreat to avoid personal injury, and in another case the coroner was summoned to investigate and to hold me responsible for a child's death. Through the support and encouragement of my brother practitioners, however, I was enabled to persevere until the operation became established as a legitimate procedure.

Intubation has now become so thoroughly recognized as a practical and successful operation, that I believe it to be a duty the medical profession at large owe to the public, that at least one physician in every village, town and city throughout this great country, should possess the necessary instruments, pluck and skill to successfully perform this operation.

If intubation were no more successful than tracheotomy, these instruments should still form a portion of the necessary armamentarium of every well equipped practitioner, that he might be able to prevent strangulation (in cases where tracheotomy would not be permitted) during the course of one of the most dangerous and distressing diseases with which we, as physicians, have to contend. I have witnessed nothing more distressing than death by

strangulation, being helpless to afford relief by the refusal of parents to permit the opening of the trachea. By reference to the comparative statistics of these operations, it will be seen that intubation is not secondary in importance to tracheotomy, for not only are we permitted to operate where tracheotomy would not be allowed, but after operating we can then save as large a per centage of cases at all ages, and a much larger proportion under the age of three years.

The object of this volume is to give all the information possible upon the subject of intubation.

As the operation requires a maximum amount of manual dexterity, in order that it may be performed gently and quickly, it necessarily follows that one cannot become an expert without some practical experience, and cannot reach the highest degree of perfection without a great deal of it. The more knowledge, however, that one possesses of intubation, and of the anatomy of the larynx, together with its relations, the easier will it become to acquire the *technique* of the operation. As an aid to those who desire to practice it, a brief chapter will be devoted to the anatomy of the larynx. (In treating of the anatomy of the larynx, Gray has been recognized as authority, while many of the illustrations are

from Gray, Sajous, Sir Morell Mackenzie, and the Reference Handbook of the Medical Sciences, modified so as to properly illustrate the text.) Special directions will be given for performing the operation, and to those who are still skeptical and at the risk of being wearisome, a brief record of all my cases will be given, together with statistics of the operation collected from all parts of the United States.

The amount of correspondence that has been necessary in order to answer the many inquiries that have been made in regard to intubation, leads to the hope that this small volume may be acceptable. If it proves to be a help to those endeavoring to give relief in hours of deadly peril, it will not have been written in vain.

70 Monroe St.

THE AUTHOR.

## CONTENTS.

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### CHAPTER I.

#### HISTORY OF INTUBATION.

PAGE.

Bouchut's Attempts and Failure — O'Dwyer's Investigations — The Gradual Development of the Operation. 13

### CHAPTER II.

#### ANATOMY OF THE LARYNX.

The Cartilages of the Larynx — Epiglottis — Thyroid — Cricoid — Arytenoids — Cornicula Laryngis — Cuneiform — The Cavity of the Larynx — The Glottis — True Vocal Cords — False Vocal Cords — Action of the Larynx During Deglutition — Relations of Larynx..... 28

### CHAPTER III.

#### DIRECTIONS FOR PERFORMING INTUBATION.

Familiarity with the Instruments — Selection of Proper Position of Child — Relation of the Index Finger to the Epiglottis and Tube — Directions when Membrane is Crowded Down Ahead of the Tube..... 35

CONTENTS.

CHAPTER IV.

AFTER TREATMENT.

	PAGE.
Dangers Following the Operation — Feeding of the Patient — Remedies Indicated — Directions for Emergencies — When to Remove the Tube, . . . . .	49

CHAPTER V.

Record of Cases . . . . .	58
---------------------------	----

CHAPTER VI.

Comparative Value of Intubation and Tracheotomy . . . . .	102
---	-----

## ILLUSTRATIONS.

	PAGE.
Fig. 1. Bouchut's Tube. - - - - -	13
" 2 and 3. O'Dwyer's First Tube - - - - -	16
" 4. O'Dwyer's Second Tube - - - - -	16
" 5. O'Dwyer's First Elliptical Tube - - - - -	16
" 6. O'Dwyer's Second Elliptical Tube as first employed by Author - - - - -	17
" 7. Obturator - - - - -	17
" 8. Gag - - - - -	17
" 9. Introducer - - - - -	18
" 10. Extractor - - - - -	18
" 11. O'Dwyer's Set of Five Tubes - - - - -	19
" 12. O'Dwyer's Latest Tube - - - - -	20
" 13. O'Dwyer's Improved Extractor - - - - -	20
" 14. Author's Gag - - - - -	21
" 15. Deep Tubing - - - - -	22
" 16. High Tubing - - - - -	22
" 17. Author's Rubber Artificial Epiglottis - - - - -	23
" 18. Author's Tube with Artificial Epi- glottis attached - - - - -	23
" 19. Author's Tube with Improved Metal Epiglottis - - - - -	24
" 20. Author's Set of Instruments - - - - -	27
" 21. External appearance of Larynx - - - - -	28
" 22. Epiglottis - - - - -	29

	PAGE.
Fig. 23. Thyroid Cartilage - - - - -	20
" 24. Arytenoid, Cornicula Laryngis and Cuneiform Cartilages - - - - -	29
" 25. Cricoid Cartilage - - - - -	29
" 26. Epiglottis during easy respiration	30
" 27. Larynx during deglutition - - - - -	30
" 28. Larynx and its relations - - - - -	33
" 29. Proper method of holding Introducer - - - - -	36
" 30. Proper method of holding Extractor	36
" 31. Scale for selecting proper size Tube	37
" 32. Author's Tube with Thread attached - - - - -	38
" 33. Proper position of Patient - - - - -	39
" 34. Proper position of Operator and Assistants - - - - -	40
" 35. Introduction of Tube - - - - -	41
" 36. Tube passing under the Finger	42
" 37. Diagram showing direction taken by Tube during its introduction	43
" 38. Showing course taken by the Tube during its introduction - - - - -	44
" 39. Author's Trachea Forceps - - - - -	45
" 40. Extraction of the Tube - - - - -	46
" 41. Author's Respirator - - - - -	47
" 42. Atomizer for Bi-chloride of Mercury Solutions - - - - -	51
" 43. Large Steam Atomizer - - - - -	56
" 44. Long Tube for Bronchocelle - - - - -	99
" 45. Bronchocelle - - - - -	100

## CHAPTER I.

### HISTORY OF INTUBATION.

Many times in the past, catheters have been introduced into the trachea, through the larynx, in order to relieve impending suffocation. In 1801 Desault accidentally introduced a catheter into the trachea instead of the œsophagus. This accident led him to repeat the operation in cases of laryngeal sten-



Fig. 1. First Intubation Tube as used by Bouchut in 1858.

osis. Catheterization of the larynx has occasionally been performed, yet no great amount of success has resulted. In 1858 Bouchut, of Paris, first performed intubation. His tubes were short (see Fig. 1), barely reaching below the glottis, and were introduced by means of a hollow sound. A thread was

attached to the tube for the purpose of removing it, and, this being allowed to remain, proved the cause of much annoyance. Bouchut reported seven cases, two of which recovered after the subsequent performance of tracheotomy. Being enthusiastic over his new operation, he condemned tracheotomy and thus incurred the enmity of those who believed in the latter operation.

A committee was appointed from the Paris Academy of Medicine to investigate the new operation of Bouchut. This committee, which included Trousseau, one of the greatest of tracheotomists, reported unfavorably upon the operation. In the discussion which followed Bouchut and his operation were so bitterly criticised that he became discouraged and abandoned it altogether. So effectually was it crushed out that no further investigations were made in this direction for nearly a quarter of a century. The bitterness of the controversy over this operation may be, in a measure, inferred from the following extract, taken from the Paris *Medical* of January 15th, 1887, which is still edited by E. Bouchut. In an article on "Resurrection du tubage de la glotte dans le croup," Bouchut says:

"Tubage of the larynx, which the enemies of the author believed dead, stirs itself beneath the shroud of academic eloquence in which it was involved. The clever heads of the times thought that their judgment was without appeal, and, that once

buried, that method was to be lost in forgetfulness and oblivion. But it appears that it has come to life again, and its merits have been discovered in America so far as to give it admission to the customary practice of surgeons. This is not done to satisfy our professors, but it has that effect, and no one has protested. Tubage had among us been buried alive, and, after thirty years, I am witness of its resurrection. It comes to us ready to meet the attacks of its ancient enemies, of whom the more bitter have, happily, left this world, and are buried in merited forgetfulness. ‘Dead dogs don’t bite.’ At this time tubage is the order of the day, and it is practiced, in croup, by the physicians of the large cities of America, to whom it gives results which permit it to compete with tracheotomy. It has even crossed the Atlantic, and, behold, the French journals are happy to speak of it to the profit of their readers.”

In 1880 Dr. O'Dwyer commenced his experiments with intubation, being unaware of the efforts and failure of Bouchut in this direction. During the first few years his work was entirely among hospital patients, who were young, puny and cachectic. His results were necessarily discouraging under these circumstances, and one less persevering would have abandoned the work in despair. Indeed, his patient, ingenious, persistent work, challenges the admiration of every one. In all these trials, however, he had one consolation,

Tracheotomy, among the same class of patients, gave equally poor results.

His first tubes were bivalves, with wire heads covered with gutta percha (Figs. 2 and 3). The



Fig. 2.



Fig. 3.

First Tubes used by O'Dwyer in 1880.

next improvement consisted in constructing the head of metal (Fig. 4). These tubes were introduced closed by means of a curved wire which passed through a loop on the inner side of each blade. When the tube was introduced and detached from the wire the blades expanded. These tubes were soon proven to be defective, as false membrane would be crowded between the blades, caus-



Fig. 4. Second Tube devised by O'Dwyer. Fig. 5. O'Dwyer's first Elliptical Tube, ing obstruction. The straight hollow tube (Fig. 5) was then substituted for the bivalve. These tubes were short, not differing much from those of Bou-chut, excepting that they were elliptical instead of

cylindrical, thus preventing undue pressure upon the vocal cords. The tubes were next increased in length (Fig. 6). Through the courtesy of Dr.



Fig. 6. O'Dwyer's second Elliptical Tube and the pattern as first used by the Author, O'Dwyer, I was provided with a set of instruments while they were in this primitive condition, and introduced the operation into my private practice. The instruments consisted of five tubes of various sizes, suitable for different ages; an obturator for each tube (Fig. 7) which screwed upon the intro-



Fig. 7. Obturator for attaching the Tube to the Introducer.

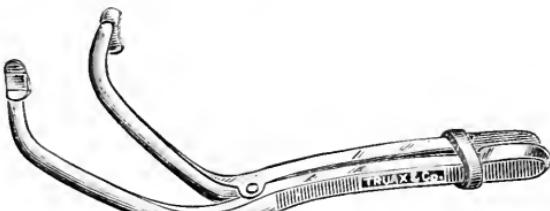


Fig. 8. O'Dwyer's Gag.

ducer (Fig. 9), a gag (Fig. 8) for holding the mouth open, and an extractor (Fig. 10). The tubes were



Fig. 9. O'Dwyer's Introducing Instrument.



Fig. 10. O'Dwyer's first Extractor.

plain and slender, and there was nothing to retain them in position but their length and weight. The heads were so small that when introduced they rested upon the true vocal cords. In private practice it was found that these tubes were frequently ejected, often within a few hours after introduction. It soon became evident that the heads were too small, for with my third pa-

tient the tube passed through the glottis and into the trachea. In another patient, not being able to find the tube, after death the trachea was opened, and it was found with the head near the bifurcation. The ingenuity of Dr. O'Dwyer however, overcame these obstacles to success. The tube was made with a bulge in the middle (Fig. 11) which pre-

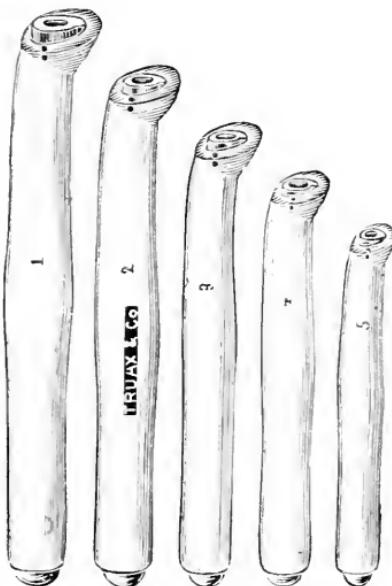


Fig. 11. O'Dwyer's set of five Tubes.

vented its easy ejection, unless it became occluded by false membrane, while the head of the tube was considerably enlarged. With these modified tubes it was my good fortune to save eight patients out of seventeen consecutive cases. The report of these cases did much toward stimulating faith in the procedure, and encouraged both Dr. O'Dwyer and myself to renewed vigor in prosecuting the work.

The heads of the tubes have been still further increased in size, (Fig. 12,) and the first extractor (Fig. 10) has been replaced by the one illustrated by Fig. 13.



Fig. 12. O'Dwyer's latest Tube.

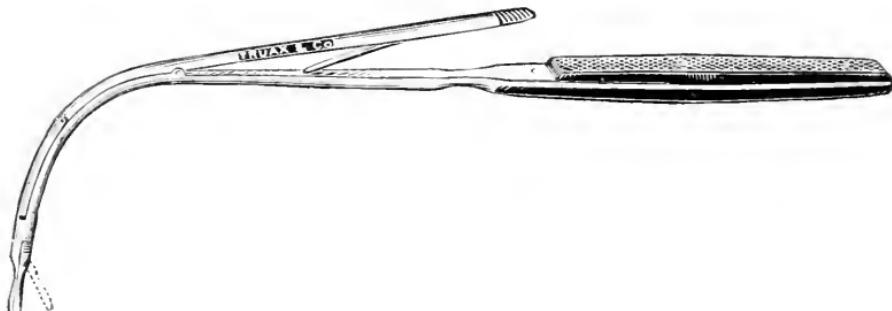


Fig. 13. O'Dwyer's improved Extractor.

Dr. O'Dwyer's gag (Fig. 8) was found objectionable on account of the extremities striking the shoulder of the patient, thus forcing it from the mouth and endangering the safety of the operator on account of the liability of his being bitten. Acting on a suggestion made by Dr. S. A. McWilliams,



Fig. 14. Author's Gag.

I had a gag constructed (Fig. 14), so shaped that the handles would extend directly backward from the angle of the mouth instead of downward, thus overcoming this difficulty. This modified gag I have used for more than two years, and, after having tried many other patterns, prefer it to anything else I have yet seen.

The greatest objection that has been raised to intubation has been on account of the difficulty in swallowing. Children with diphtheria do not relish solid or semi-solid foods, they crave liquids, and these they cannot take on account of the violent coughing that they produce from dropping through the open tube. Other operators have modified the tubes by making them short and with small heads. Figure 15 represents the position of a tube with a small head as it rests in the larynx, while Figure 16 represents the position of a tube with a large head. Dr. O'Dwyer's judgment is that a patient swallows no better with a tube with a small head than with a larger one. It has appeared to me that the patients swallow a little better with the smaller head, although the difference is not great.

There are two fatal objections to the use of the tubes with the small heads. First, is the difficulty that is often encountered in removing them where they rest low in the larynx, and second, the danger of falling through the glottis and into the trachea. These disadvantages have been observed by others

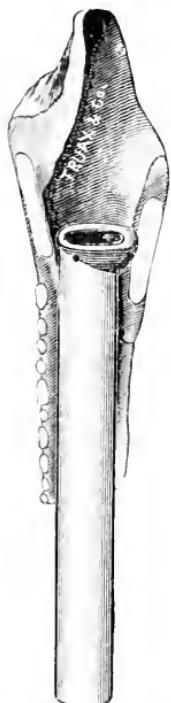


Fig. 15. Showing the position of a tube with a small head as it rests in the Larynx and on the true vocal cords.



Fig. 16. Showing the position of a tube with a large head as it rests in the Larynx and on the false vocal cords.

as well as myself, and the further use of tubes with small heads should not be encouraged. In order to overcome the difficulty of swallowing liquids I have long been at work to discover some method by which the upper opening of the tube might be

safely and effectually closed during deglutition. My first device for this purpose is illustrated by Figures 17 and 18, and consisted of a rubber collar with an artificial epiglottis attached.

During deglutition the rising of the larynx and the falling of the epiglottis presses the rubber cap over the opening of the tube, thus closing it. It was found that while in many cases this device



Fig. 17. Author's Rubber Artificial Epiglottis.



Fig. 18. Author's Tube with Rubber Epiglottis attached.

worked admirably, yet in others it seemed to be of no advantage. This was undoubtedly due to the disarrangement of the rubber collar during the introduction of the tube, or subsequently from coughing.

My efforts were then directed to discover a method of covering the opening by some means that could not be disarranged. After much thought and experimentation, the tube illustrated by

Figure 19 was devised\*. This tube has a large head with a metal epiglottis attached, the latter being controlled by a spring of coiled gold wire imbedded in the upper part of the tube. In order to guard against sudden suffocation, in case any accident should occur to the spring, a slot is made through



Fig. 19. Author's Tube, with Improved Metal Epiglottis,  
showing Obturator in position.

the head on each side and very near to its upper margin. This device works almost perfectly, and a child, if fed properly, can take any amount of liquid nourishment or even water, with impunity. I consider it one of the greatest improvements that has yet been made in the advancement of the operation. By the use of these tubes we will not only add greatly to the comfort of the patient by permitting the administration of liquids, but I am convinced that we will save a larger proportion of

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\* I am indebted to Chas. Truax & Co., Chicago, for the mechanical work, which is admirably done.

cases, and that we will less frequently meet with broncho-pneumonia.

The difficulty of swallowing liquids, with the open tubes, has been so great that some have abandoned the operation, declaring that they would not again use them until they were so modified as to enable a patient to drink, and to allay the thirst which is often the cause of the greatest suffering after the operation. Others, again, entirely prohibit the use of liquids of any description during the few days in which the tube is worn. The thirst is often so intense and the suffering so great as to lead the friends to regret the operation and to blame the physician for prolonging the life of the patient and increasing the agony of its last hours. Indeed, I have so frequently seen a patient grasp a cup so frantically and cling to it so tenaciously, with all its feeble strength, that it has been an inspiration to continued experiments, and I have often vowed to leave no stone unturned until I had devised some method of overcoming this objectionable feature of intubation. The ability to swallow safely has been so marked by the use of the metal epiglottis, and the comfort of the patients so greatly increased, that I am confident the operation will be looked upon with more favor in the future, and that those who have faltered will renew their faith.

Nothing can exceed the delicacy of the mechanism by which this metal epiglottis is controlled, and

it is to be hoped that the operation will not be brought into disrepute by the market being flooded with imperfect and unsafe instruments. Would that every manufacturer of this device could appreciate that upon the perfect working of the delicate gold thread which controls it, depends the safety of a human life. However, if properly constructed, these instruments are perfectly safe, and the profession can guard against imperfect instruments by insisting upon the certificate of some expert as to the quality and reliability of their construction.

There is an important feature of all tubes, of whatever pattern, that is often overlooked by instrument makers, as well as by physicians using them, and to which Dr. O'Dwyer attaches a great deal of importance. He states that "Those usually made will produce ulceration in every case where worn for any considerable time." The defect is in the lower end of the tube at the anterior surface, it being made too thin and sharp. Every time the patient coughs or swallows the end of the tube is brought forcibly in contact with the anterior wall of the trachea, and only a few hours are necessary with the ordinary tube to produce a deep erosion. The anterior surface of the lower end of the tube should be made thick, rounded and perfectly smooth. If many who cannot understand the reason of their failures will examine the lower end of their tubes, or will make post mortem examinations, they will find an occasional cause at least, for their failures.

Figure 20 illustrates a full set of modified instruments such as I am using at this writing, and comprises the gag (Fig. 14), introducer (Fig. 9),

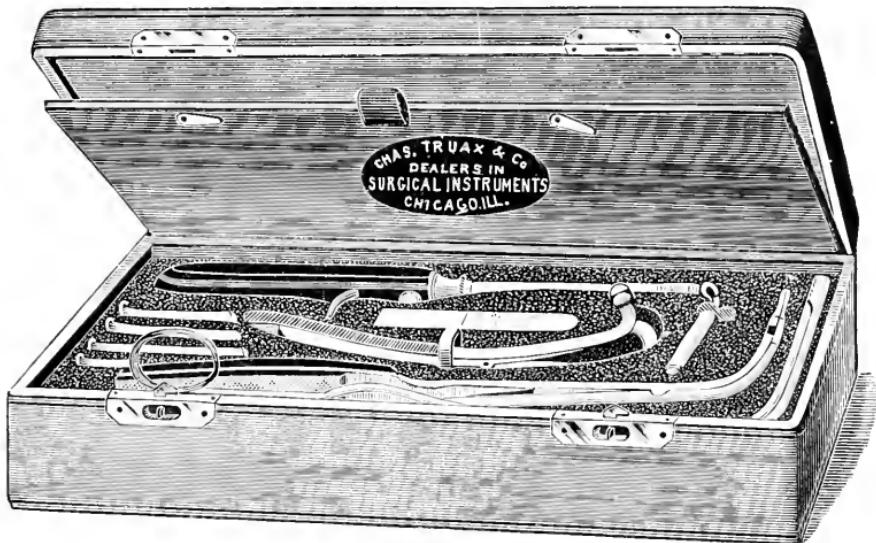


Fig. 20. Author's set of Instruments in Case.

extractor (Fig. 13), five tubes with metal epiglottis (Fig. 19), scale (Fig. 31), trachea forceps (Fig. 39), respirator (Fig. 41), and rubber cots for the finger.

To obtain the best possible results with intubation, it is necessary that the operation should be gently, quickly and skillfully performed, employing only the most approved patterns of instruments, and those manufactured by reliable and intelligent instrument makers, as slight defects in the instruments may prove fatal to success.

## CHAPTER II.

### ANATOMY OF THE LARYNX.

It is not intended in this connection to give a detailed description of the anatomical structure of

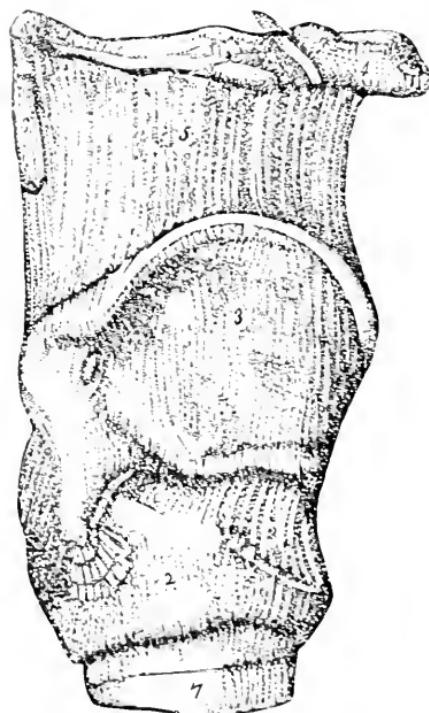


Fig. 21. External appearance of the Larynx.  
(Reference Hand Book of the Medical Sciences.)

the larynx, but simply to give a general idea of the larynx and its relations. Those wishing a more

minute description are referred to the standard textbooks on anatomy.

The larynx, which is situated between the base of the tongue and the trachea, is composed of nine cartilages. These cartilages, bound together by various ligaments and muscles, form a box-like structure, which is triangular in shape above, elliptical in the center, and nearly circular below, as it unites with the trachea. Figure 21, taken from the Reference Hand Book of the Medical Sciences, well illustrates the external appearance.



Fig. 22. Epiglottis (Gray).

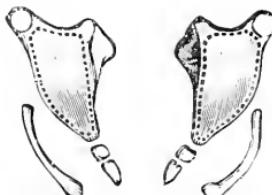


Fig. 24. Cornicula Laryngis,  
Arytenoids and Cuneiform (Gray).

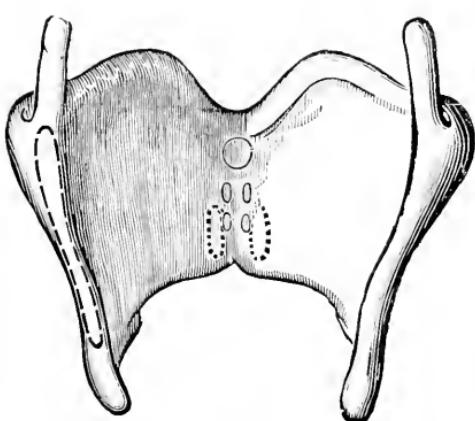


Fig. 23. Thyroid Cartilage (Gray).

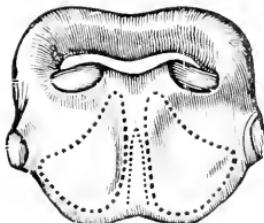


Fig. 25. Cricoid (Gray).

The cartilages of the larynx are the epiglottis (Fig. 22), thyroid cartilage (Fig. 23), two cuneiform, two cornicula laryngis, two arytenoids (Fig. 24), and the cricoid (Fig. 25). The epiglottis is situated at the upper part of the larynx, and is attached to the thyroid cartilage in the angle between the two alae. During repose the upper, or free border, is directed upward and curved slightly forward towards the base of the tongue. Figure 26 represents the position of the epiglottis during easy respiration. During deglutition the larynx rises, the ventricular bands, or false vocal cords contract, almost completely closing the larynx, and affording a cushion upon which the epiglottis rests as it falls backwards. Thus, the larynx is guarded against the entrance of fluids or solids. Figure 27 represents the appearance of the larynx during deglutition.

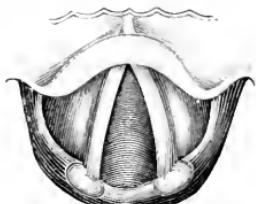


Fig. 26. Epiglottis during easy respiration.  
(Modified from Mackenzie).

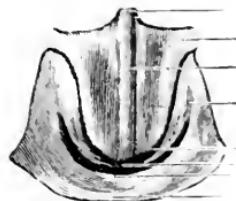


Fig. 27. Larynx during deglutition.  
(Modified from Sajou).

The thyroid cartilage forms the upper and larger part of the larynx, and consists of two lamella, or alae, united at an acute angle in front.

The cricoid cartilage forms the lower part of the larynx. It is smaller, but thicker and stronger than the thyroid and articulates posteriorly with the arytenoid cartilages. The latter are pyramidal in

shape, and assist in forming the back part of the larynx. The apex of each cartilage is curved backwards and inwards, and each is surmounted by a small conical-shaped nodule, the corniculum laryngis. The cuneiform cartilages are two small, elongated, cartilaginous bodies, extending from the apices of the arytenoid cartilages to each side of the epiglottis.

The interior of the larynx is lined with mucous membrane, it being a continuation of that lining the buccal and nasal cavities. It is important to remember, in this connection, that the mucous membrane of the nasal passages, the mouth, pharynx and the posterior of the larynx above the vocal cords, consists of squamous epithelium, while that of the lower half of the epiglottis, the anterior portion of the larynx above the vocal cords, the whole interior of the larynx below the vocal cords, as well as that lining the trachea and broncial tubes, is of the columnar variety.

This difference in the structure of the mucous membrane accounts for the fact that in diphtheria the false membrane that appears in the pharynx is an infiltration *into* the mucous membrane, and when the false membrane is removed, the mucous membrane is removed with it, leaving a bleeding, excoriated or ulcerated surface, while the membrane that appears wherever columnar epithelium exists is an exudation *upon* the surface of the mucous membrane, and when the exudate is removed, the mucous membrane remains intact.

The superior aperture of the larynx is a triangular opening, wide in front and narrow behind, and sloping obliquely downward and backward. It is bounded in front by the epiglottis, behind by the apices of the arytenoid cartilages and the cornicula laryngis, and laterally by the aryteno-epiglottian folds, which consist of mucous membrane, ligamentous and muscular tissue enclosing the cuneiform cartilages (See Fig. 26). The cavity of the larynx extends from the superior opening to the lower border of the cricoid cartilage. It is divided into two parts by the vocal cords. Between the vocal cords is a long, narrow, triangular fissure or chink called the glottis, or rima glottidis (See Fig. 26). The portion of the larynx above the glottis is triangular in shape, while below it is first elliptical and then circular, gradually conforming to the shape of the trachea.

The two superior or false vocal cords are situated above the true vocal cords, and are formed by a folding in of the mucous membrane, and by the cuneiform cartilages which are inclosed. (Fig. 26.) The inferior or true vocal cords are concerned in the production of sound, while the false vocal cords are not. The true vocal cords (see Fig. 26) consists of two strong fibrous bands, covered on their surface by a thin layer of mucous membrane. Each cord consists of a band of yellow elastic tissue and is attached anteriorly to the thyroid cartilage between the two alæ and posteri-

orly to the anterior angle of the base of the arytenoid cartilage.



Fig. 28. Showing position of Larynx and its relations  
(modified from Mackenzie).

On each side of the larynx are situated the great blood vessels and nerves of the neck. It is bounded above by the pharynx and base of the

tongue, anteriorly by muscles, cellular tissue and integument, below by the trachea and posteriorly by the œsophagus. Figure 28 represents very clearly the relation of the larynx to the pharynx, tongue and œsophagus.

## CHAPTER III.

### DIRECTIONS FOR PERFORMING INTUBATION.

The physician who wishes to become expert in performing any operation, should first thoroughly familiarize himself with the instruments that he intends to use. This is especially important in the case of intubation, as it is done entirely by the sense of touch. One should handle the instruments frequently and practice working the spring of the introducer, which, by the way, should be operated by the thumb (Fig. 29) and not by the forefinger. The extractor should be held in the same manner. (Fig. 30). It will be a help if one practices introducing the tube into the closed hand of another, detaching the tube and pressing it down out of sight. As the extraction of the tube is even more difficult than its introduction, it is important to also practice extracting the tube from the closed hand and to become accustomed to the feeling of the head of the tube and to appreciate the form of the opening in whatever position it may be placed. The instrument should be held lightly and the

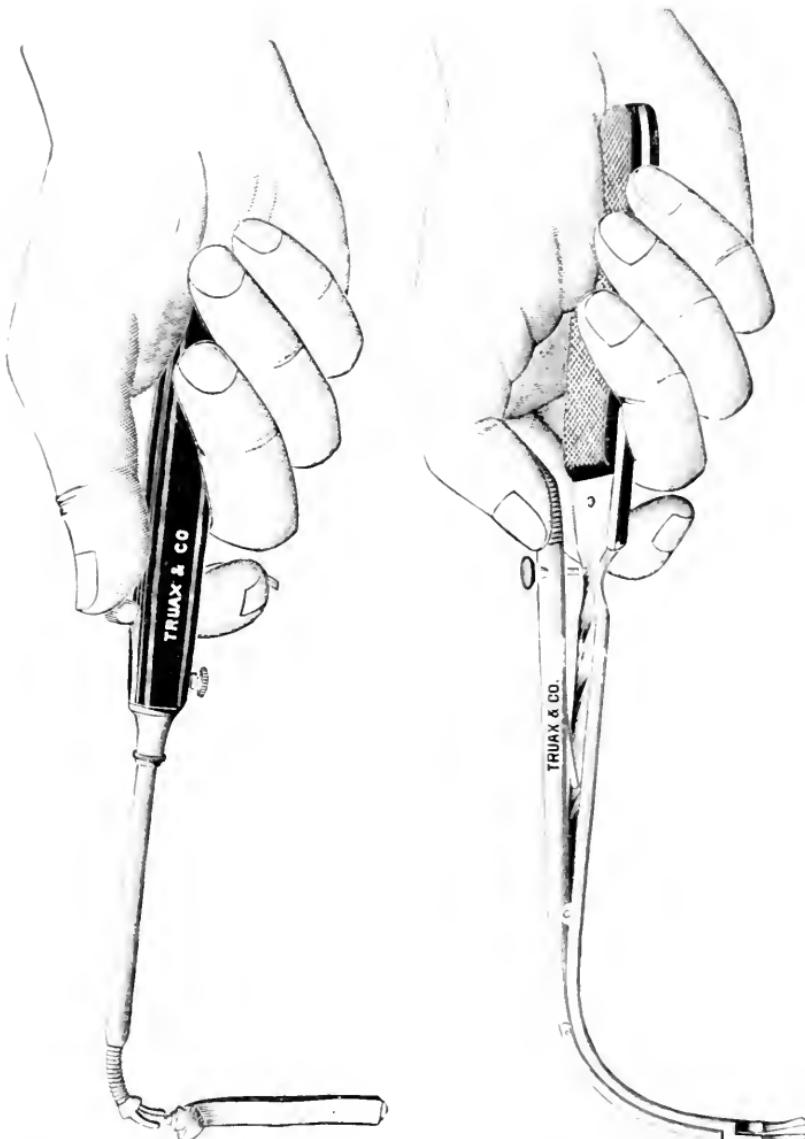


Fig. 29. Showing proper method of holding the introducer.

Fig. 30. Showing proper method of holding the extractor.

operation should be performed with the utmost gentleness. I have no sympathy for those who de-

clare the instruments are not strong enough, and who break their gags, their introducers or extractors. The same quickness and gentleness that is employed in passing a catheter should be exercised in passing a tube into the larynx. No force should be used, no anaesthetic is required, and the operation should not require longer than from five to ten seconds. It is not only important to become perfectly familiar with the instruments and the details of the operation, but if possible, with the anatomy of the larynx by practical work upon the cadaver.

In performing the operation the physician should first select a tube suitable to the age of the patient, the smallest being suitable for a child under two years; (see Fig. 11) the next in size is appropriate



Fig. 31. Scale for selecting proper size tube.

for one between two and four; the next for one from four to six; the next from six to eight; the next from eight to ten, and if the extra tube is included in the set, it is appropriate for a child from ten to fourteen years. A suitable tube, however, may be selected by reference to the scale (Fig. 31) which accompanies each set.

The tube should be threaded with braided silk or linen thread, making a loop (Fig. 32) about sixteen inches in length. The obturator should then be screwed upon the introducer, and the tube attached (Fig. 29). The instrument is then ready for use,

and should be placed upon a table within easy reach. The patient, properly wrapped, should be held upright in the lap of a nurse, closely against the left chest, with the head resting on the shoulder (Fig. 33). The nurse should sit upright in a straight-backed chair, and the patient should be held firmly and not be permitted to slide down. The fore-arms of the child should be crossed in front, and the nurse should grasp the wrists. An

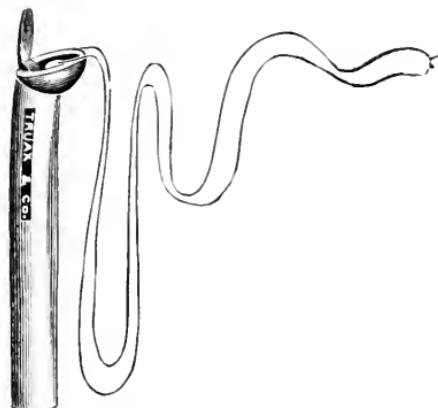


Fig. 32. Author's tube with thread attached.

assistant, standing behind, should hold the head securely and slightly backwards. The gag should be introduced in the left angle of the mouth, well back between the teeth, and widely opened. The operator should then quickly seize the introducing instrument with the tube attached, hook the loop over the little finger of the left hand, and introduce the index finger of the same hand, closely followed by the tube (Fig. 34). He may simply hook the epiglottis forward with the index finger (Fig. 35),

and guide the end of the tube gently over it, when, by making an abrupt turn, he will pass the tube



Fig. 33. Proper position of patient;

into the larynx if he has been careful to keep in the median line; or, he may pass the index finger over

the epiglottis and upon the arytenoid cartilages (Fig. 36) and guide the end of the tube into the larynx. In either case the end of the tube should pass



Fig. 34. Proper position of operator and assistants.

*under the tip of the finger, not over it or by the side of it, but directly under it.* The moment the

end of the tube is passed into the larynx it should be detached from the introducer by pressing forward on the slide, and, as the instrument is removed,

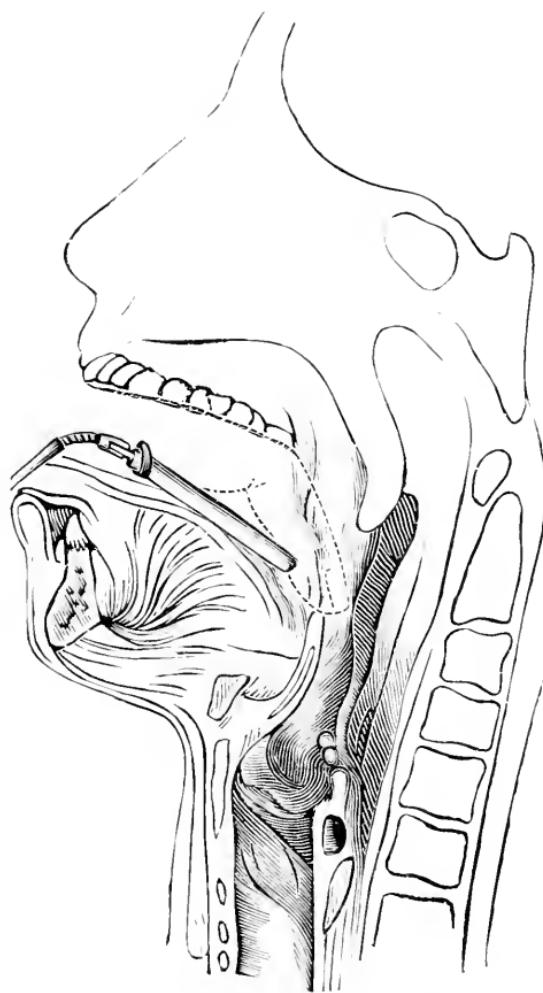


Fig. 35. Tube passing over the epiglottis.

the tube should be pressed down into position by the finger, which should still remain within the

pharynx. No thought should be given to the handle of the introducing instrument, but the mind should be concentrated upon the end of the tube.

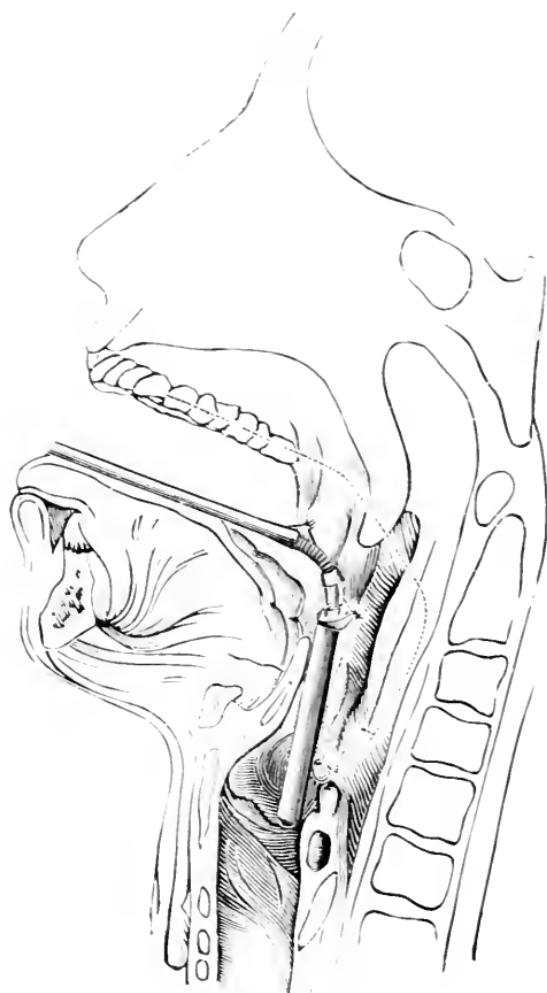


Fig. 30. Tube passing under the finger.

This should describe a gentle curve until it has passed over the epiglottis, and then it should remain

stationary for an instant while the handle is quickly elevated, so that the tube may go down at a right angle, as shown by Figure 37.

Figure 38 represents the curve that should be made by the end of the tube while it is being introduced. The dark line indicating the path it should follow.

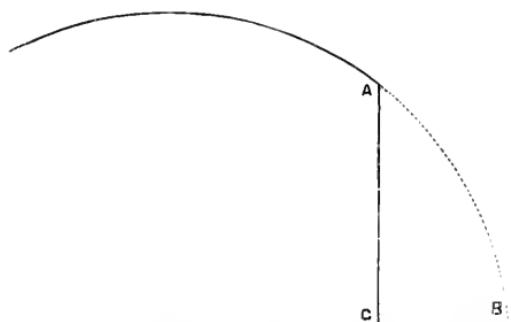


Fig. 37. "A" Representing the point where the progress of the tube should be arrested until it can be passed directly downwards toward B.

The above turn constitutes the trick of the operation, for if the curve be continued as indicated by the dotted lines, the tube will invariably pass into the œsophagus.

That it has entered the larynx will be indicated by violent coughing, and by easy respiration. A drink of water, if the O'Dwyer tube is used, will also produce coughing. If it has passed into the œsophagus, no relief is given, there is no violent coughing, and there is gradual shortening of the loop as the tube gravitates toward the stomach. If quite certain that it has entered the larynx, the gag should be removed, and the loop should be

placed backward over the ear. The operator should wait a few minutes to make sure that the tube is in position, and to allow the cough to expel the ropy



Fig. 38. The dark line showing the course the tube should follow.

mucus and softened membrane. He should then cut the loop near the mouth, replace the gag and introduce the index finger of the left hand until it

reaches the head of the tube; by pulling on one end of the loop it is quickly removed, leaving the tube within the larynx.

In introducing the tube, if false membrane is crowded down ahead of it, which cannot be expelled by coughing, then the tube should be removed at once. If it cannot then be expelled, the trachea forceps (Fig. 39), which I have had constructed for this purpose, should be introduced and the membrane removed. If this is not successfully accomplished, and the patient seems about to suffocate, tracheotomy should at once be performed.

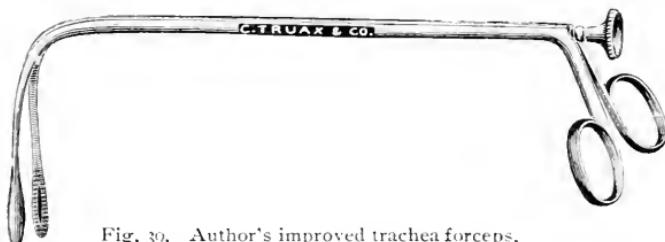


Fig. 39. Author's improved trachea forceps.

In extracting the tube, the patient should be placed in the same position as when it was introduced. The gag should be placed as before, and the index finger of the left hand introduced until it reaches the head of the tube. The extractor in the right hand should quickly follow the finger, the point of which should be guided into the tube (Fig. 40). By pressing on the lever above the handle the jaws of the instrument are separated, thus holding the tube securely while it is removed. If the tube

cannot be removed after a few gentle and careful attempts, then an anaesthetic should be given.



Fig. 40. Extraction of tube.

In performing the operation, a rubber cot with the end cut off should be placed on the index finger to prevent injury from the child's teeth providing the gag should slip.

As an additional precaution a pad of antiseptic gauze (Fig. 41) should be placed over the mouth and nostrils of the operator, and secured by a rubber tape passed around the head.

The importance of these precautions has been emphasized within the last year by the death of two honored members of the profession within the limits of my personal acquaintance. Dr. Newton, of this city, in performing intubation, was severely bitten by a patient who was suffering from a severe form of diphtheria. Within three days he was taken with the same disease, which rapidly extended to the



Fig. 41. Author's respirator.

larynx, trachea and bronchial tubes. Although he ejected membranous casts of the larynx, trachea and larger bronchial tubes, and received unremitting attention from his professional friends, who made every effort to save a most valuable life, yet death occurred on the fourth day from exhaustion and extension of membrane to the finer bronchi.

Dr. G. W. Mason, of Bloomington, Ill., a most skillful physician, and an honor to his profession, sacrificed his life to this dread disease at the very beginning of a brilliant and successful career. In an exhausted condition, and with the self-forgetful-

ness of the ideal physician, he responded to the pathetic appeal for help in a case of diphtheritic croup. Within three days he was taken with the disease in its most dangerous form, which quickly proved fatal. The inexpressibly sad termination of these lives should teach us the lesson of self-protection.

A vial of nitrite of amyl should always be at hand, as suggested to me by Dr. D. S. Clark, of Rockford, not only when the tube is introduced, but when removed as well. If a patient is moribund, it will have a powerful effect upon the heart, and will be of great assistance in resuscitating the patient. It may be unnecessary to state, in this day of antiseptic surgery, that the physician should be particularly careful to thoroughly disinfect not only the instruments, but his hands as well. He who performs this operation upon a diphtheritic patient and hastens to a case of confinement without this precaution is guilty of a negligence that will very likely cost a woman her life. The tubes and other instruments should be disinfected with 95 per cent carbolic acid, and then cleansed with boiling water, while the hands may be disinfected with either a strong solution of carbolic acid or bi-chloride of mercury. The scrubbing brush should be used freely, and the nails thoroughly cleaned. The bi-chloride of mercury solution should not be used for disinfecting the instruments, as it destroys the plating.

## CHAPTER IV.

### AFTER TREATMENT.

After the tube has been introduced the patient usually experiences entire relief, and generally falls into a quiet, refreshing sleep. If, however, the membrane has extended into the bronchial tubes, only partial relief will follow. Among children, however, in the great majority of cases death will occur from laryngeal obstruction, before the bronchial tubes become invaded. Partial relief after intubation is as rare as after tracheotomy. The change in the appearance of the patient is not only immediate but remarkable. Before the operation all the horrible symptoms of strangulation are witnessed. The loud stridor of croup is heard all over the house. The child is bathed in perspiration, the eyes seem starting from their sockets, the features are livid, the lips blue, and the patient tosses about the bed vainly endeavoring to find relief, often clutching at the throat as if to tear it open, and begging piteously for help. After the operation these symptoms abate, as if by some magic power. The

patient lies pale and quiet. The loud stridor is replaced by almost noiseless respiration, and death is held at bay.

We will now watch the respiration and count its rate carefully, for it will indicate more to us than the pulse rate or temperature. It now numbers from twenty to twenty-five per minute. Every thing seems encouraging, the friends are elated, and often we are led to foster a false hope. Frequently within twelve, twenty-four, or thirty-six hours, the respiration becomes more rapid, numbering forty per minute, increasing to fifty, sixty, or eighty. What does it indicate? Either the gradual extension downward of the membrane into the smaller bronchial tubes, or the presence of pneumonia. In cases of the latter the rapid respiration is attended by sudden elevation of temperature, by bronchial respiration, dullness on percussion and later by crepitant râles. These evidences of pneumonia are usually confined to one side.

In case of the extension downward of the membrane, the rapid respiration is attended by dry, frequently mixed with moist bronchial râles, usually observed in both lungs. There is an absence of dullness on percussion and of bronchial respiration. These symptoms are usually the harbingers of death. In only one instance have I known of recovery after their occurrence. (Case 43.)

The physician should give no encouragement as to recovery until forty-eight hours after the opera-

ation, when if there has been no increase in the rapidity of the respiration he may entertain strong hopes of recovery. Before this time it is not safe to venture upon a prognosis, however favorable the case may appear. I have known the most hopeful cases to die from the rapid extension of the false membrane and the apparently hopeless ones to recover.

The most common cause of death after intubation, as after tracheotomy, is the extension of false membrane into the bronchial tubes. I know of no line of treatment that will prevent it. Many use the bi-chloride of mercury, one twenty-fourth or thirty-second of a grain, well diluted, every hour, unless vomiting or diarrhoea is produced, when it is given less frequently or omitted altogether. While I have employed this method of treatment faithfully, I cannot say that I have confidence in it. I have seen it fail so frequently that I am inclined to be sceptical in regard to its virtues when used for this purpose.

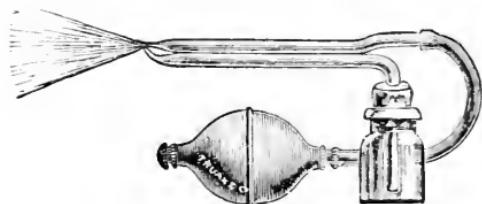


Fig. 42. Atomizer with glass tube for solutions of bi-chloride of mercury.

If the walls of the pharynx are covered with diphtheritic membrane, the bi-chloride of mercury is indicated for its antiseptic properties, and I use it

diluted with alcohol, in the proportion of one grain of the former to four ounces of the latter, applying it with a hand atomizer, with a glass or hard rubber instead of metal tube. (Figure 42.) I also use in the same manner the following combination:

R. Acidi Carbolici,	-	-	-	-	-	gr vi.
Potass. Chl.,	-	-	-	-	-	9 i.
Glycerinæ,	-	-	-	-	-	½ ss.
Aquaæ Calcis, ad.,	-	-	-	-	-	½ ij.
Mix.						

If the pharyngeal diphtheria is mild and the child rebels against the use of the atomizer, it should be omitted. Iron mixtures, whisky, brandy or anything irritating, should be avoided, for by falling through the tube and into the bronchi they are liable to produce inflammation.

Quinine pills may be given, when desired, to the older children, while to the younger ones quinine may be given, dissolved in water, and injected per rectum. Should the temperature become elevated, antipyrin or antifebrin should be given by the rectum; the former in ten or fifteen grain doses, the latter in from five to eight. Should there be danger from prostration, brandy and milk or brandy and the beef peptinoids should be given every two hours by enema. If bronchitis or pneumonia occurs, warm flax seed poultices, well covered with oil-silk, should be applied to the chest, both behind and in front, secured over the shoulders and at the sides.

If there is considerable obstruction from mucus

and softened membrane below the tube, and the pulse is weak and feeble, the following may be given:

R	Ammon. Carb.,	-	-	-	-	-	gr xvi.
	Tr. Nucis Vomicæ,	-	-	-	-	-	gtt xvi.
	Spts. Mindereri,	-	-	-	-	-	ij.
	Syr. Simp.,	-	-	-	-	-	ij.
Mix et Sig.							Teaspoonful every two hours for a child two years old.

As liquids of all kinds produce more or less irritation, thus inviting the extension of the membrane, they should by all means be avoided when the open tube is used, and the patient should be given solids or semi-solids exclusively. Ice cream and ice shaved fine may be given to quench the thirst; while bread or crackers, softened in milk, may be given for nourishment. Rice, tapioca, soft eggs and other similar food, may also be given when relished.

If the tube with the metal epiglottis is used, liquids may be given without limit, provided they are given half a teaspoonful at a time, with the head inclined forwards, and the child directed to swallow rapidly. If a child drinks from a cup, and especially with the head elevated, some of the liquid will trickle into the tube before the effort is made to swallow. Dr. Elmer E. Babcock, of this city, has suggested to me the advisability of requiring the patient to drink while lying with the face down. This suggestion is a good one, and I shall adopt it with the older children. The effort of swallowing will thus force the metal cap down over the opening

of the tube, and no fluid can enter. If the case progresses favorably, I believe but little treatment is required. Keep the patient in a warm, well ventilated room, at an even temperature, avoid drafts, require the patient to remain in bed, and sustain it by suitable nourishment and such as can be swallowed without producing coughing.

The question has often been asked, when should the tube be removed? To this, no definite answer can be given, as it depends altogether upon circumstances. It may be necessary within twelve or twenty-four hours after its introduction, from accumulation of membrane below the tube. If everything progresses favorably, I usually remove it on the fourth day, after which I rarely find it necessary to again introduce it. If the patient does not take nourishment well, and there is great danger from exhaustion, it should be removed on the second or third day.

After the introduction of the tube the patient will speak in a whisper and the cough will be peculiar, there being no tone to it. It must be borne in mind that there is always danger lurking about these cases, from the detachment of membrane below the tube, thus occluding it. When this occurs, the tube will almost always be ejected. There are two special directions that should always be given to the attendants, and their importance emphasized. First to raise the child to a sitting position whenever a violent coughing spell occurs,

and second, if taken with a choking spell and it seems about to suffocate, to take it by the feet and shake it with the head down while at the same time a sharp blow is given upon the chest. The reasons for these directions are obvious. There is always some risk that a tube may be ejected during a hard coughing spell, and if the patient is lying upon the back it may be swallowed. This accident has occurred repeatedly. Many times I have been called to remove a tube because a patient was breathing hard and it was believed there was some obstruction below the tube. A moment's close watching, however, convinced me that the tube was gone. The moment the patient cries or coughs, the absence of the tube will be apparent. The voice will then have some tone to it (while before it was only a whisper) and the cough at once becomes croupy.

In case of sudden detachment of membrane below the tube, during the absence of the physician, the expulsion of the tube may be aided by inverting the child as directed.

Ordinarily a patient needs but little attention from the physician, but there are times when it is necessary that a physician should be in constant attendance in order to extract the tube at a moment's notice, and to perform tracheotomy if necessary.

Occasionally within twenty-four or thirty-six hours after the operation a peculiar, frequent hoarse cough is heard. This indicates partial

occlusion of the tube from detached membrane, and should be a warning to the physician to be in close attendance. A steam atomizer (Fig. 43) should now be in constant use in order to soften and dissolve the membrane. A saturated solution of lime water is an efficient and convenient solvent. It may be here stated that the

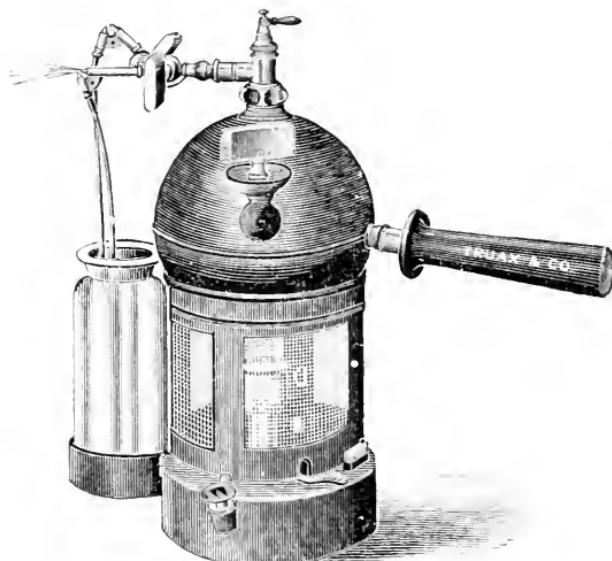


Fig. 43. Large steam atomizer as used by the author.

vapor from slacking lime or the steam from a croup kettle containing a turbid solution of lime has no effect upon false membrane, simply for the reason that the steam or vapor contains no lime salts, as they are not evaporated with the steam. Lime water, however, in the form of a spray from a steam atomizer, is one of the most efficacious solvents.

If the cough continues frequent, hoarse, becomes somewhat loose, and especially if there is any obstruction to easy respiration, the tube should be extracted. In many instances, violent coughing follows the extraction of the tube, the child strangles, and, after struggling for a moment, expels a large membranous cast of the trachea. If the membrane is not expelled, and the child seems upon the verge of suffocation, the trachea forceps (Fig. 39) should be quickly and gently introduced and the membrane withdrawn. If these fail, no time should be lost. The trachea should be opened and the membrane removed. Tracheotomy having been performed, it is better to insert a tracheotomy tube, which should be worn for a few days. The neck should be well enveloped with antiseptic gauze to prevent the entrance of cold air and foreign particles, and every effort made to conduct the case to a successful issue. Such accidents rarely occur, but a physician will not do his whole duty if he does not act promptly in meeting these desperate emergencies.

## CHAPTER V.

### RECORD OF CASES.

As the full value of an operation can only be determined by a careful investigation of the results in quite a number of cases, I here present a brief history of my first one hundred and fifty operations, and, although this number is not large, I believe it sufficient to fairly demonstrate that intubation of the larynx possesses nearly if not quite all the advantages claimed for it. In none of the following list of cases was the operation performed until severe and increasing dyspnoea demanded surgical interference. In a few instances where I have been called in consultation I have declined to operate, believing that the patients would recover without it. Frequently I have delayed operating at my first visit, but being subsequently called, found it necessary to do so in order to further prolong the life of the patient. In the great majority of these cases I was called in consultation with other physicians and the operations performed as a last resort after all other modes of treatment (excepting tracheotomy) had been found useless, and the patients practically given up to die. Although

quite a number of these cases were of such a malignant form as to prevent the possibility of a successful recovery, yet I have invariably operated, believing that the temporary relief afforded was worthy of the sacrifice of a good statistical record.

*Case 1.*—April 19th, 1885. I was called to see a child two years old, in the last stages of croup. There was but a slight amount of diphtheritic membrane present on the tonsils. The constitutional symptoms of diphtheria were mild, but the dyspnoea resulting from laryngeal obstruction was most urgent, and had been present two and a half days. There was deep sinking in of the walls of the chest with every inspiration, the voice was gone, the cough suppressed, the surface bathed in perspiration, the pulse rapid and feeble, the lips blue and the face of a deadly pallor. The child was fast passing into a comatose condition and seemed beyond human aid. It was evident that something must be done and that quickly. It was with many misgivings that I proposed intubation. I had never seen the operation performed and had not known of its being done in private practice. The parents, however, anxious to accept of any means excepting tracheotomy (to which they positively objected) that might afford relief, readily gave their consent. On the third attempt the tube was successfully introduced into the larynx and the change in the appearance of the child was remarkable. The labored respiration was at once relieved and the patient soon rallied and became conscious of its surroundings. A few hours later it ate a cup full of bread softened with milk and in a whispering voice called for candy. Drs. Steele and McWilliams were invited to see the patient and expressed their approval of what had been done and their satisfaction

at the relief that had been given. Twelve hours after the operation the tube was coughed out and was replaced. Twenty-four hours after the operation the respiration had become very rapid and the temperature elevated to 103°. The bronchial tubes being invaded, the tube was removed and as respiration now seemed as easy as with it, it was not again introduced. The patient died twelve hours later.

*Case 2.*—April 23d, 1885. Case in my own practice. Termination, fatal. Age, three years. Wore tube eighteen hours. Cause of death, extension of membrane. Child had been sick three days and the dyspnoea extreme when the operation was performed. Twelve hours after the operation the tube, which was one of the primitive ones, dropped below the vocal cords, which was indicated by the return of the voice. Gave the child ether six hours later and with the assistance of Dr. Steele removed the tube. The parents would not consent to its reintroduction and as the bronchial tubes were invaded it was not urged. Diphtheritic symptoms were mild.

*Case 3.*—July 16th, 1885. Courtesy Drs. Hatfield and Casselberry. Termination, fatal. Age, sixteen months. Wore the tube twenty-four hours. Cause of death, extension of membrane and accumulation of mucus below the tube. Diphtheritic symptoms severe.

*Case 4.*—September 15th, 1885. Courtesy Dr. Behrend. Termination, recovery. Age, five years. Wore tube seven days. Ejected the tube several times, but in each instance it was necessary to again introduce it on account of the urgent dyspnoea. Diphtheritic symptoms slight and the danger simply from suffocation. Membrane was ejected on the introduction of the tube.

*Case 5.*—September 24th, 1885. Courtesy Dr. Richardson. Termination, fatal. Age, two years and seven months.

Wore the tube six days. Cause of death, pneumonia. Diphtheritic symptoms severe and dyspnoea urgent.

*Case 6.*—November 3d, 1885. Courtesy Drs. Dahlberg and Appleby. Termination, recovery. Wore tube four days. Age, twenty months.

*Case 7.*—November 9th, 1885. Courtesy Drs. Nelson and Bosworth. Termination, fatal. Age, four years. Wore tube forty-eight hours. Cause of death diphtheritic toxæmia. It was almost a malignant form of diphtheria with invasion of the larynx.

*Case 8.*—November 13th, 1885. Courtesy Dr. Kossakoski. Termination, recovery. Age two years and two months. Wore tube two weeks. Symptoms of diphtheria slight. Membrane in the larynx and symptoms of suffocation *most urgent*. This patient was seen by Dr. Selwyn Clark, of Rockford.

*Case 9.*—November 16th, 1885. Courtesy Dr. Kossakoski. Termination, fatal. Age, three years. Wore tube thirty hours. Cause of death, extension of membrane. Diphtheritic.

*Case 10.*—November 20th, 1885. Courtesy Drs. Hatfield and Casselberry. Termination, fatal. Age, five years. Wore tube fifty hours. Cause of death, extension of membrane and pneumonia of left lung. There was extensive exudation in bronchial tubes before the operation was performed.

*Case 11.*—November 21st, 1885. Courtesy Dr. Valin. Termination, recovery. Age, five years. Patient wore the tube five days, when it was ejected. Convalescence rapid. This was a diphtheritic case with well marked constitutional symptoms.

*Case 12.*—November 30th, 1885. Courtesy Dr. Holroyd. Termination, fatal. Age, three years. Died thirty-six hours after operation from congestion of the lungs. The patient had been suffering from diphtheria for six days when the larynx became involved. Thirty hours after the invasion of the larynx the child was in "extremis." Intubation was performed at 10 p. m. At 2 a. m. the tube, with a piece of membrane two inches in length, was expelled. Before reaching the patient it was again in "extremis." At 3 a. m. the tube was again introduced with immediate relief. At 5:45 a. m. tube was again expelled, but was again introduced at 6:15. There were now symptoms of congestion of the lungs. Temperature 103 3-5°, pulse 155, respiration 48. At 9 p. m. temperature 105, pulse 180, respiration 60. Patient died at 4:25 a. m.

*Case 13.*—December 2d, 1885. Courtesy Dr. Charles E. Caldwell. Termination, recovery. Age, five years. Wore tube four days. Child had measles followed by pharyngeal diphtheria. The membrane invaded the larynx and the case was considered hopeless. Child revived after the operation, and did well for four days, when it coughed up the tube and swallowed it. Wore the tube in the intestinal canal with comfort for three weeks, when it was passed per rectum.

*Case 14.*—December 3d, 1885. Courtesy Dr. Dahlberg. Termination, recovery. Age, four years. Patient wore the tube four days. The constitutional symptoms of diphtheria were slight. No membrane visible, although the child was in "extremis" from laryngeal obstruction. When the tube was introduced it was at once expelled with a membranous cast of the larynx. The same tube was again introduced and remained until removed on the fourth day.

*Case 15.*—December 9th, 1885. Patient in my own practice. Termination, recovery. Age, four years. The patient wore the tube three days. The child had been sick several days with diphtheria and was dying from suffocation when the tube was introduced with the assistance of the father and mother. The tube was removed on the third day and convalescence occurred rapidly.

*Case 16.*—December 11th, 1885. Courtesy Dr. Pierpoint, of Englewood. Termination, fatal. Age, three years. Death occurred forty-eight hours after the operation from extension of membrane to the bronchi. The case was apparently a hopeless one, the patient being greatly reduced from diphtheria.

*Case 17.*—January 4th, 1886. Courtesy Drs. Quine and Willard. Termination, recovery. The patient wore the tube three days. Age, four years and nine months. This was a case of purely membranous laryngitis. No membrane was at any time observed upon the tonsils, uvula or pharyngeal walls. Membrane, however, was expelled when the tube was introduced. The patient was in a most critical condition at the time of the operation, and all present were firm in the belief that it would have died in a very few hours. The relief was as immediate and marked as if a cord tightly encircling the neck had been suddenly severed. The next day the patient was dressed and played about the room, having her playthings upon a table in one corner. Every day while wearing the tube she was dressed and about the house and on one occasion helped her mother to wipe the dinner dishes. This was the most remarkable case that has come under my observation, on account of the entire absence of all diphtheritic symptoms, the low condition of the child when the operation was performed, and the prompt and entire relief afforded by the operation. On

the third day, assisted by Dr. Willard of this city and Dr. Kimball of Rockford, the tube was removed and the child suffered no further inconvenience.

*Case 18.*—January 9th, 1886. Courtesy Dr. Miller, of Kensington. Termination, fatal. Age, three years. Patient died twenty-four hours after the operation from exhaustion. The case was diphtheritic, with invasion of the larynx and the child actually dying when the operation was performed. It was entirely unconscious and the tube was introduced without resistance. Artificial respiration was performed and the child fully revived.

*Case 19.*—January 12th, 1886. Courtesy Dr. Charles E. Caldwell. Termination, fatal. Age, two years. Diphtheritic. Patient died twenty-four hours after the operation from accumulation of mucus and softened membrane below the tube, together with exhaustion.

*Case 20.*—January 13th, 1886. Courtesy Dr. Charles E. Caldwell. Termination, fatal. Age, four years. Child died thirty-six hours after the operation from broncho-pneumonia. Diphtheritic. The patient was moribund, pulseless, limp and unconscious when the operation was performed.

*Case 21.*—January 13th, 1886. Courtesy Dr. Charles E. Caldwell. Termination, fatal. Age, seven years. Patient died forty-eight hours after the operation from exhaustion and extension of membrane into smaller bronchi. It was almost a malignant form of diphtheria.

*Case 22.*—January 25th, 1886. Courtesy Dr. Dahlberg. Termination, fatal. Age, five years. Patient died two days after the operation in convulsions.

*Case 23.*—January 26th, 1886. Courtesy Dr. Dyas. Termination, fatal. Age, two years and two months. Died

twenty-four hours after the operation from the malignancy of the disease.

*Case 24.*—January 28th, 1886. Courtesy Dr. Berry. Termination, fatal. Age fourteen months. Died second day after the operation, with symptoms of pneumonia.

*Case 25.*—January 28th, 1886. Courtesy Dr. C. E. Caldwell. Termination, fatal. Age, eleven months. Died twenty-four hours after the operation from exhaustion. This was a case of nasal and pharyngeal as well as laryngeal diphtheria.

*Case 26.*—February 6th, 1886. A patient in my own practice. Termination, fatal. Age, thirteen months. Died twenty-four hours after the operation from exhaustion. A case of pharyngeal diphtheria followed by laryngeal obstruction.

*Case 27.*—March 1st, 1886. Courtesy Dr. Steele. Termination, fatal. Age, four years. Died forty-eight hours after the operation from pneumonia of left lung. A case of pharyngeal diphtheria followed by invasion of the larynx.

*Case 28.*—March 5th, 1886. Courtesy Dr. McGinnis of Brighton. Termination, fatal. Age, seven years. Died sixty hours after the operation. A case of pharyngeal diphtheria with invasion of bronchia as well as of the larynx.

*Case 29.*—March 6th, 1886. Courtesy Dr. Hoadley. Termination, recovery. Age, two years. Wore the tube seven days. It was first removed on the third day, but it was necessary to again introduce it. On seventh day again removed the tube, and the patient made a very satisfactory recovery. A case of pharyngeal diphtheria with invasion of the larynx.

*Case 30.*—March 8th, 1886. Courtesy Drs. Kippax and Adams. Termination, fatal. Age, eight years. A

case of pharyngeal diphtheria with invasion of the larynx. Patient died three days after the operation from extension of membrane into bronchi. Intubation was performed with immediate relief, and the patient did well for two days, when there was detachment of a large mass of membrane below the tube, followed by immediate suffocation. When seen a few minutes later it was apparently dead. Artificial respiration was performed, and the tube extracted. The child partially reviving, the trachea was opened and a mass of membrane several inches in length removed. A tracheotomy tube was introduced and the child fully restored to consciousness. There was, however, rapid extension of the membrane, and the child died twenty-four hours later.

*Case 31.*—March 9th, 1886. Courtesy Dr. R. L. Rea. Termination, fatal. Age, two years. Child died within twenty-four hours from exudation of membrane in bronchi. This case was exhausted by diphtheria and only partially relieved by the operation on account of the previous extension of membrane into the lower trachea and larger bronchi.

*Case 32.*—March 11th, 1886. Courtesy Dr. Behrendt. Termination, fatal. Age, two years. Died forty-eight hours after operation from pneumonia. Diphtheritic case and child almost dead when the operation was performed.

*Case 33.*—March 13th, 1886. Case in my own practice. Termination, fatal. Age, nine months. Patient wore the tube three days, and finally died sixteen hours after its removal, from exhaustion. This case was characterized by diphtheritic patches upon the walls of the pharynx and by symptoms of suffocation showing the invasion of the larynx.

*Case 34.*—March 15th, 1886. Courtesy Dr. Wm. E. Hall. Termination, fatal. Age, seventeen months.

Child died twenty-four hours after the operation from exhaustion and bronchial obstruction. This was a very bad diphtheritic case.

*Case 35.*—March 25th, 1886. Courtesy Dr. Van Doozer. Termination, fatal. Age, seven years. Patient died twenty-four hours after the operation from sudden asphyxia. The case was a diphtheritic one and the child in a most critical condition when the operation was performed. It, however, rallied and did remarkably well for twenty-four hours, when there was partial detachment of membrane below the tube and the respiration became considerably embarrassed. The tube was extracted, when the child at once became blue and ceased to breathe. The tube was again introduced and artificial respiration performed, but it was impossible to resuscitate the patient.

*Case 36.*—March 27th, 1886. Courtesy Dr. Charles E. Caldwell. Termination, fatal. Age, three years. Died thirty-six hours after the operation from extension of membrane into bronchi. A diphtheritic case and the patient nearly dead when the operation was performed.

*Case 37.*—March 29th, 1886. Courtesy Dr. S. A. McWilliams. Termination, recovery. Age, seven years. Wore the tube three and a half days. This was a diphtheritic case and the child was almost dead from asphyxia and exhaustion, but nevertheless made a perfect recovery.

*Case 38.*—March 31st, 1886. Courtesy Dr. Parsons. Termination, fatal. Age, seven years. Died three days after the operation from extension of membrane into the bronchi. Diphtheritic.

*Case 39.*—April 25th, 1886. Courtesy Drs. Fenger and Storck. Termination, fatal. Age, two years. Patient died two days after operation from extension of membrane and

detachment below the tube. The child did remarkably well for the first thirty-six hours. After this there was evidence of exudation in bronchial tubes, and as the respiration was somewhat embarrassed the tube was extracted. Suffocation occurred at once and although the child struggled violently, could not expel the membrane from the trachea. The tube was again introduced, but without relief, and the child died in a very few moments. This case, as well as cases 30 and 35 showed the urgent necessity of having at hand some instrument for the purpose of removing false membrane from the trachea when detachments of large masses occur below the tube. For overcoming this difficulty the trachea forceps (See Figure 6) were devised, since which they have answered a very useful purpose.

*Case 40.*—April 28th, 1886. Courtesy Dr. Lawless. Termination, fatal. Age, seven years. Child died twenty-four hours after the operation from suffocation following the ejection of the tube. A diphtheritic case with invasion of the larynx. The child was promptly and perfectly relieved and did remarkably well until the next day, when the tube was ejected. Was called, but before reaching it, an hour later, death occurred from suffocation.

*Case 41.*—April 29th, 1886. Courtesy Dr. Tillotson. Termination, recovery. Age, eight years. Wore the tube two days. Diphtheritic case with invasion of larynx. Symptoms urgent. Intubation performed with immediate relief. The tube was ejected two days later, but it was not necessary to again introduce it and the patient made a satisfactory recovery.

*Case 42.*—May 3d, 1886. Courtesy Dr. Berry. Termination fatal. Age, three years. Diphtheritic. Child moribund, but revived after the operation, and the next day was found, dressed and playing in the water, as it ran from

the faucet. Died forty-eight hours later, from pneumonia, undoubtedly due to the want of proper care and attention.

*Case 43.*—May 5th, 1886. Courtesy Drs. Steele and Lawless. Termination, recovery. Age, fourteen months. Wore the tube three and a half days. Diphtheritic patches upon the tonsils, and the child almost dead from laryngeal obstruction. Intubation gave immediate relief. The baby did well for two days, when the tube was removed. As respiration was carried on with difficulty, the tube was again introduced. The child did poorly for the next twenty-four hours, the respiration being rapid and somewhat embarrassed and moist sibilant râles were heard in both lungs. Little hope of recovery was entertained. The tube was removed, but the child was still unable to carry on respiration without it, and it was again introduced. Twelve hours later the patient was found in convulsions, and while not severe, were of frequent occurrence. The case now seemed entirely hopeless, but it was thought best to remove the tube, which was done while the child was in the stupor following a convulsion. The respiration, although rapid, numbering seventy per minute, was easily performed, and the tube was dispensed with. The bromides were given per rectum to control the convulsions, and carbonate of ammonia given in the milk as soon as the child was able to swallow. As the moist sibilant râles continued flax seed poultices well covered with oil-silk, were applied to the chest. Gradually the little one improved, and in a few days was on the safe road to recovery, and is at this writing as fine and healthy a child as is to be found in the city of Chicago.

*Case 44.*—May 6th, 1886. Courtesy Dr. Clendening. Termination, fatal. Age, two years. Diphtheritic. When intubation was performed the child was moribund, extremi-

ties cold and pulseless. The patient was entirely unconscious, and would have died in a few minutes. The tube was inserted and artificial respiration performed. In a short time consciousness returned. After taking nourishment the child passed into a quiet sleep, awaking bright and happy. For three days it did remarkably well, giving every promise of recovery. Gradually, however, the membrane invaded the smaller bronchi, producing a fatal result.

*Case 45.*—May 10th, 1886. Courtesy Dr. D. Collins. Termination, recovery. Age, three years. Case of scarlet fever, complicated with diphtheria with invasion of larynx. Child well covered with the eruption of scarlet fever. The throat presented the characteristic appearance of diphtheria and the symptoms arising from laryngeal obstruction were urgent. On the third day the tube was removed, but it was necessary to again introduce it within a few hours. On the fifth day the tube was again removed and the patient made a satisfactory recovery.

*Case 46.*—May 16th, 1886. Courtesy Dr. Tillotson. Termination, recovery. Age, three years. Wore the tube six days. This was a brother to case 41, upon whom intubation was performed on April 29th.

*Case 47.*—May 20th, 1886. Courtesy Dr. Tillotson. Termination, fatal. Age, fourteen months. Died forty-eight hours after the operation from uremic convulsions. Diphtheritic with laryngeal invasion and sister to case 41 and 46. Another child in the same family suffered from a severe form of diphtheria, but recovered without the larynx becoming involved.

*Case 48.*—May 22d, 1886. Courtesy Drs. Johnson and Mannheimer. Termination, fatal. Diphtheritic. Intubation gave great relief, but the smaller bronchi were already

invaded and the child greatly prostrated from the diphtheria. The patient died suddenly a few hours after the operation, and directly after drinking, either from heart failure or detachment of membrane below the tube.

*Case 49.*—May 26th, 1886. Courtesy Dr. McDonald. Termination, fatal. Age, five years. A bad case of diphtheria which implicated the larynx. The patient wore the tube three days with great relief and died two days after its removal from diphtheritic toxæmia.

*Case 50.*—May 27th, 1886. Courtesy Drs. Johnson and Mannheimer. Termination, fatal. Age, three years. Diphtheria of the nasal passages, pharynx, larynx and bronchial tubes. The operation gave but slight relief, the patient dying within a few hours. This patient was a sister of case 49.

*Case 51.*—June 5th, 1886. Courtesy Drs. J. H. Hollister and Woodall. Termination, fatal. Age, seven years. The operation gave great relief, but the patient died suddenly sixteen hours later, after drinking. The cause of death was believed to be heart failure.

*Case 52.*—June 9th, 1886. Courtesy Dr. Clendening. Termination, fatal. Age, two years. The operation gave the usual relief. The tube was removed on the third day, and the child did well for two days, when the reformation of the membrane required me to again introduce the tube. The child took nourishment poorly and died twelve days after the operation was first performed and twelve hours after its last removal. The tube had been removed several times in the meantime, but in each instance it was necessary to replace it.

*Case 53.*—June 9th, 1886. Courtesy Drs. Bogue and Shepherd. Age, four years. The child was in a very bad

condition, both tonsils were covered with membrane, and the larynx invaded. The dyspnoea was intense. The patient wore the tube for four days with great comfort, when it was removed, being no longer required. The recovery from croup was perfect, but death occurred two weeks later from nephritis.

*Case 54.*—June 11th, 1886. Courtesy Dr. Barbank. Termination, fatal. Age, ten months. The baby died twenty-four hours after the operation from the severity of the constitutional symptoms.

*Case 55.*—July 14th, 1886. Courtesy Dr. Thomas. Termination, recovery. Age, eight years. The constitutional symptoms of diphtheria light, and but small amount of membrane upon the tonsils. The symptoms of laryngeal obstruction, however, were most urgent. The tube was expelled on the second day, and the symptoms became so alarming that it begged to have it replaced, and as quickly as possible. On the fourth day it was removed, and recovery quickly followed.

*Case 56.*—July 28th, 1886. Courtesy Dr. J. V. Bacon. Termination, fatal. Age, nine months. The baby was nearly dead from diphtheritic poisoning, as well as from laryngeal obstruction, and died twelve hours later.

*Case 57.*—August 16th, 1886. Case in my own practice. Termination, fatal. Age, five years. This was a bad case of pharyngeal diphtheria, with invasion of the larynx. There were two other children sick with diphtheria in the family. The tube was removed on the third day, and the child remained comfortable for a day without it. The reformation of the membrane, however, again necessitated the introduction of the tube, and the child died on the fifth day from bronchial obstruction.

*Case 58.*—August 13th, 1886. Courtesy Dr. McDavitt of Winona. Age, nine years. The child claimed to have had a hedge thorn in the mouth, when suddenly it was taken with a choking spell, and the thorn disappeared. Symptoms of inflammation of the mucous membrane of larynx followed, and Dr. McDavitt performed tracheotomy when the child was upon the point of death from suffocation. The child recovered, but the tracheotomy tube could not be removed, as it seemed almost impossible to get enough air through the larynx. The patient was brought to me several months after the accident. There appeared to be almost complete stenosis of the larynx. The child was anaesthetized and a curved sound passed down through the larynx. A small intubation tube was then introduced, followed by still another of larger size. This was violently expelled together with a large membranous cast of the larynx. A large intubation tube was now introduced and the tracheotomy tube removed. The child now breathed through the natural passages, for the first time in several months. The next morning the tube was expelled, and as respiration was carried on with perfect comfort it was not introduced again. An attack of pneumonia followed, from which the child, however, safely recovered.

*Case 59.*—September 2d, 1886. Courtesy Dr. Bates. Termination, recovery. Age, nine months. Wore the tube four days. This little patient, a nursing infant, was in the last stages of suffocation. There was pharyngeal as well as laryngeal diphtheria and two other children in the family were suffering from the disease. The baby rallied after the operation and although desperately sick made a splendid recovery.

*Case 60.*—September 12th, 1886. Courtesy Dr. Steurnagle. Termination, fatal. Age, four years. A diphther-

itic case with the usual symptoms of laryngeal obstruction. The operation gave immediate relief, but patient died three days later from extension of membrane into the bronchial tubes.

*Case 61.*—September 27th, 1886. Courtesy Dr. Steele. Termination, recovery. Age, four years. Patient almost dead from suffocation. Wore the tube four days and made a rapid recovery. A diphtheritic case.

*Case 62.*—September 29th, 1886. Courtesy Dr. —. Termination, fatal. Age, twenty-three months. The infant was almost dead and it was considered that it could not live over half an hour without relief. Intubation gave the usual relief. Child died two days later from bronchial obstruction. Diphtheritic.

*Case 63.*—September 30th, 1886. Case in my own practice. Termination, recovery. Age, eight years. The patient had been suffering several days from diphtheria when the larynx became involved. The child was in a desperate condition when the operation was performed. The usual relief was afforded. The tube was removed on third day and the patient made a good recovery. This patient was seen by Dr. Steele and Dr. Sullivan.

*Case 64.*—October 4th, 1886. Courtesy Dr. Tallman of South Englewood. Termination, fatal. Age, four years. Patient died on third day from pneumonia. Diphtheritic.

*Case 65.*—October 7th, 1886. Case in my own practice. Termination, fatal. Age, two and one-half years. Patient died three days after the operation from extension of membrane into the bronchi. A diphtheritic case and sister to case 61.

*Case 66.*—October 10th, 1886. Courtesy Drs. Emrick and Dal. Termination, recovery. Age, two years. Wore

the tube four days and made an excellent recovery. A diphtheritic case. The father of this patient had tracheotomy performed upon himself, when six years old, for the relief of diphtheritic croup, and although his own life had been saved by the operation, he would not permit it to be performed upon his child, consequently I was called upon to perform intubation, which fortunately saved the little one's life.

*Case 67.*—October 13th, 1886. Courtesy Dr. Barlow. Termination, fatal. Age, three years. A bad diphtheritic case and bronchial tubes as well as larynx invaded. The operation gave only partial relief and the patient died within a few hours.

*Case 68.*—October 18th, 1886. Courtesy Dr. James G. Berry. Termination, recovery. Age, two years and ten months. Wore the tube four days. A diphtheritic case and the child almost dead from suffocation. The recovery was a surprise to all.

*Case 69.*—October 20th, 1886. Courtesy Dr. Tallman of South Englewood. Termination, fatal. Age, seven years. The patient died four days after the operation from pneumonia. Diphtheritic.

*Case 70.*—October 21st, 1886. Courtesy Dr. \_\_\_\_\_. Termination, fatal. Age, three years. A bad diphtheritic case and bronchial tubes already invaded. Child died the next day.

*Case 71.*—October 21st, 1886. Courtesy Drs. Steele and Riley. Termination, fatal. Age, two years and ten months. Diphtheritic. Patient died twenty-four hours after the operation from pneumonia and convulsions.

*Case 72.*—October 31st, 1886. Courtesy Dr. Berry. Termination, fatal. Age, two years and three months. Pa-

tient died thirty-six hours after the operation from extension of membrane into bronchial tubes.

*Case 73.*-- November 6th, 1886. Courtesy Drs. Oliver and Kauffmann, Washington Heights. Termination, fatal. Age, three years. Diphtheritic. Child almost dead. Intubation gave immediate relief. In about two hours the tube was expelled, and before reaching it an hour later it was again nearly dead. A larger tube was introduced, but it was followed in a few hours by pneumonia, and the child died thirty hours later.

*Case 74.*-- November 11th, 1886. Courtesy Dr. Earle. Termination, fatal. Age, thirteen months. A diphtheritic and a very unpromising case. The operation gave great relief, but patient died a few hours later from exhaustion.

*Case 75.*-- November 13th, 1886. Courtesy Drs. Webb and Lackner. Termination, fatal. Age, ten years. A diphtheritic case followed by extension of membrane into bronchial tubes within twenty-four hours. The tube was removed with some difficulty, as it had turned partially around in the larynx. The child died within a few minutes after its removal from heart failure.

*Case 76.*-- November 13th, 1886. Courtesy Dr. Behrendt. Termination, fatal. Age, three years. Wore the tube four days and died three days after the removal of the tube from broncho-pneumonia. Diphtheritic.

*Case 77.*-- November 17th, 1886. Courtesy Dr. Lackner. Termination, fatal. Age, six years. Diphtheritic. The operation gave the usual relief. Child died two days later from extension into bronchi.

*Case 78.*-- November 19th, 1886. Courtesy Dr. Roy, of Auburn. Termination, fatal. Age, six years. Diphther-

itic. Death occurred two days after the operation from membranous bronchitis.

*Case 79.*—November 24th, 1886. Courtesy Drs. Bates and Mulfinger. Termination, recovery. Age, four years. The patient greatly exhausted, not only from the disease, but from previous attempts, by other physicians, to perform intubation. The child was actually dying, but rallied after the operation, wore the tube with comfort for three days, then coughed it out and finally recovered. Diphtheritic.

*Case 80.*—November 29th, 1886. Courtesy Dr. Able. Termination, fatal. Age, three years. Diphtheritic. There was extension of membrane into bronchial tubes, and death two days after the operation.

*Case 81.*—December 1st, 1886. Courtesy Dr. Barlow. Termination, fatal. Age, eighteen months. Diphtheritic, and rapid extension of membrane into the bronchial tubes. The tube was removed twenty-four hours after the operation, and the patient died a few hours later.

*Case 82.*—December 1st, 1886. Courtesy Dr. Bert. Termination, fatal. Age, six years. A malignant case of diphtheria with invasion of larynx. Intubation gave relief, but the patient died the next day from exhaustion.

*Case 83.*—December 2d, 1886. Termination, fatal. Age, four years. No membrane was visible in the pharynx, and no symptoms of systemic disease, and yet the child was laboring desperately for breath. The operation gave the usual relief. The child died two days later from bronchopneumonia.

*Case 84.*—December 9th, 1886. Courtesy Dr. Chas. E. Caldwell. Termination, fatal. Age, four years. Diph-

theritic. The patient died two days later from pneumonia, which quickly followed the introduction of the tube.

*Case 85.*—December 20th, 1886. Courtesy Dr. J. G. Berry. Termination, fatal. Age, two and a half years. Relief followed the operation, but the patient died two days later. Diphtheritic. The people occupied two small rooms, and the mother was confined in the same apartments a few days later. She was attended by a midwife, became a victim to puerperal fever, dying within a few days.

*Case 86.*—December 22d, 1886. Courtesy Dr. Larkin, of South Chicago. Termination, fatal. Age, four years. Diphtheritic. Child died two days later from extension of membrane into bronchi.

*Case 87.*—December 29th, 1886. Courtesy Dr. J. G. Berry. Termination, recovery. Age, four years. Patient almost dead. Diphtheritic. The operation gave immediate relief. The child coughed up the tube one hour after its introduction together with a piece of false membrane. The respiration was easy without the tube and it was not again introduced. The membrane did not make its appearance again and the patient made a rapid recovery.

*Case 88.*—January 2d, 1887. Courtesy Dr. Banga. Termination, recovery. Age, six years. Diphtheritic. Patient wore the tube four days and then coughed it up, making a good recovery.

*Case 89.*—January 17th, 1887. Case in my own practice. Termination, fatal. Age, two years. Diphtheritic. Child died twenty-four hours after the operation from extension of membrane to bronchi.

*Case 90.*—January 20th, 1887. Courtesy Dr. Burr. Termination, recovery. Age, seven years. Diphtheritic. The child was in a very bad condition and the surroundings

most unfavorable. Coughed the tube up on the third day and made an excellent recovery.

*Case 91.*—January 20th, 1887. Courtesy Dr. J. G. Berry. Termination, fatal. Age, eighteen months. Diphtheritic. Patient died two days later from extension of membrane. In this case, during the removal of the thread from the tube, the child caught my index finger between the teeth, biting it to the bone. The wound was cauterized immediately and no serious harm resulted.

*Case 92.*—January 27th, 1887. Courtesy Dr. ——. Termination, fatal. Age, two years. Patient died three days later from extension of membrane. Diphtheritic.

*Case 93.*—February 4th, 1887. Courtesy Drs. Mitchell and Gatchell. Termination, recovery. Age, six years. A case of membranous croup. No membrane was visible at any time upon the pharyngeal walls. The child was dying from laryngeal obstruction and a small piece of membrane was ejected when the tube was introduced. The patient coughed up the tube on the third day and recovered.

*Case 94.*—February 7th, 1887. Courtesy Dr. Quine. Termination, fatal. Age, two years. Diphtheritic. The operation gave great and immediate relief, but the child took nourishment very poorly, every attempt at swallowing causing violent coughing. Broncho-pneumonia followed in a few hours and the child suffered intensely from thirst. After twenty-four hours the tube was removed to give the child water and nourishment, and was soon replaced. A few hours later, as the child begged so piteously for water, the tube was again removed. As respiration was comparatively easy it was not again introduced. On calling two hours later the child was found dead.

*Case 95.*—February 22d, 1887. Courtesy Dr. McDonald. Termination, fatal. Age, four years. Diphtheritic. This patient had a repugnance for all food and coughed badly when forced to take it. The patient was nourished almost entirely by enemas. Patient died four days after the operation from diphtheritic poisoning and exhaustion.

*Case 96.*—February 25th, 1887. Courtesy Dr. Murdock. Termination, recovery. Age, five years. Diphtheritic. The patient took an abundance of nourishment without difficulty. The tube was removed on the fourth day.

*Case 97.*—February 26th, 1887. Courtesy Dr. McDonald. Termination, fatal. Age, two years. The child presented the usual symptoms of diphtheritic croup in the last stages. Patient died the next day from exhaustion.

*Case 98.*—March 1st, 1887. Courtesy Dr. —. Termination, fatal. Age, two years. Diphtheritic. Death from extension of membrane on the second day.

*Case 99.*—March 19th, 1887. Courtesy Dr. Burry. Termination, fatal. Age, two and one-half years. Diphtheritic. Death two days after the operation from extension of membrane.

*Case 100.*—April 13th, 1887. Termination, fatal. Age, three years. Diphtheritic. Death occurred on the second day from extension of membrane.

*Case 101.*—April 19th, 1887. Courtesy Dr. Leavitt. Termination, fatal. Age, twelve years. A very bad diphtheritic case. The tube was removed on the third day, but it was necessary to again introduce it. The patient took nourishment well, but died on the fourth day from diphtheritic poisoning.

*Case 102.*—April 30th, 1887. Case in my own practice. Termination, fatal. Age, three years. Diphtheritic. Death

two days after the operation from extension of membrane to bronchi.

*Case 103.*—May 10th, 1887. Courtesy Dr. Kauffman, of Blue Island. Termination, fatal. Age, three years. Several other children in the family were down with diphtheria. In this case it invaded the larynx and death occurred three days later from extension of membrane into bronchial tubes.

*Case 104.*—May 11th, 1887. Case in my own practice. Termination, fatal. Age, four years. Diphtheritic. Death on third day from bronchial invasion.

*Case 105.*—May 24th, 1887. Courtesy Dr. Bert. Termination, fatal. Age, three years. Diphtheritic. Death on third day from extension of membrane.

*Case 106.*—June 7th, 1887. Courtesy Dr. Leavitt. Termination, recovery. Age, nine years. Diphtheritic with laryngeal invasion. Two other children in the family were down with diphtheria. Patient wore the tube four days and made a perfect recovery. This patient was seen by Dr. G. Wheeler Jones, of Danville and Dr. I. A. Larrabee, of Louisville.

*Case 107.*—June 21st, 1887. Courtesy Dr. Marr. Termination, fatal. Age, four years. Diphtheritic. The people were poor Russians and the surroundings and nursing were deplorable. This patient should have recovered, but died four days after the operation from exhaustion.

*Case 108.*—June 21st, 1887. Courtesy Dr. Keeler. Termination, fatal. Age, fourteen years. This was a bad diphtheritic case and the patient greatly prostrated from the disease. The larynx became involved and death occurred twenty hours after the operation from exhaustion.

*Case 109.*—July 14th, 1887. Courtesy Dr. E. M. Hale. Termination, recovery. Age, eighteen months. Diphtheritic. Coughed out the tube on the second day, when it was necessary to replace it. Again coughed out the tube on the fourth day and made a perfect recovery.

*Case 110.*—July 14th, 1887. Courtesy Dr. J. DeWolf. Termination, fatal. Age, four years. Diphtheritic. Death occurred two days after the operation from extension of membrane.

*Case 111.*—July 31st, 1887. Termination, fatal. Age, eighteen months. Diphtheritic. Patient died two days after operation from extension of membrane into bronchial tubes.

*Case 112.*—August 8th, 1887. Courtesy Dr. LeBarrier. Termination, fatal. Age, six years. Diphtheritic. Patient almost dead from suffocation and bronchial tubes already invaded. Patient died twelve hours later.

*Case 113.*—August 11th, 1887. Courtesy Dr. Steurnagle. Termination, fatal. Age, two years. The patient was comatose and an occasional gasp was the only sign of life. A tube was introduced and artificial respiration performed. In half an hour the child was fully resuscitated and noticed everything about it. It was left comfortable. An hour later it coughed out the tube, but as respiration was perfectly easy, it was not at once replaced. The child did well for two days without the tube, when the membrane again formed, and it was again necessary to resort to it. The patient died the next day, simply from exhaustion. Diphtheritic.

*Case 114.*—August 13th, 1887. Courtesy Dr. Kewley. Termination, fatal. Age, five years. Diphtheritic. Death

occurred two days after the operation from bronchial obstruction.

*Case 115.*—August 22d, 1887. Courtesy Dr. Price. Termination, recovery. Age, three years. Diphtheritic. The patient was comatose and artificial respiration was resorted to. The operation was performed and the patient rallied. The tube was removed on the second day, but it was necessary to again introduce it. It was again removed on the fourth day and child made a remarkable but slow recovery. Diphtheritic paralysis following the attack.

*Case 116.*—September 14th, 1887. Courtesy Dr. Burr. Termination, fatal. Age, two years. Diphtheritic. Child died two days after the operation from extension of membrane.

*Case 117.*—September 16th, 1887. Courtesy Dr. Kossakowski. Termination, fatal. Age, four years. Death occurred suddenly, two days after the operation from detachment of membrane below the tube.

*Case 118.*—September 24th, 1887. Courtesy Drs. Jacobs and Steele. Termination, recovery. Age, twenty-two months. Diphtheritic. The patient wore the tube six days, and although it was coughed out several times, it was always necessary to immediately introduce it, excepting on one occasion, when the child passed thirty-six hours comfortably without it. This little patient was seen on one occasion, by Sir Lennox Browne of London, who was delighted at the perfect comfort of the child, and who gave a compliment to the operation, by stating to the parents that more had been done for their child here than could have been done in London or Vienna. A good recovery resulted.

*Case 119.*—September 21st, 1887. Courtesy Dr. J. G. Berry. Termination, recovery. Age, four years. A case

of membranous laryngitis. No false membrane was visible on walls of pharynx. The child was dying simply from suffocation resulting from laryngeal obstruction. The tube was coughed up on the third day and the patient made an excellent recovery. This patient was also seen by Sir Lennox Browne, of London.

*Case 120.*—September 25th, 1887. Courtesy Dr. Smith. Termination, fatal. Age, six years. The child had previously suffered from enlarged tonsils and one had been removed. The other, as well as the uvula, was greatly swollen and covered with diphtheritic membrane. In addition there was laryngeal stenosis from extension of membrane into the larynx. The dyspnoea was urgent and great relief followed the operation. Although the child took nourishment well, it seemed greatly exhausted from the severity of the disease, and in two days the tube was removed. For the next two days the child improved and seemed to be recovering, when the gradual return of dyspnoea indicated the reformation of membrane in the larynx. The dyspnoea again becoming urgent the tube was again introduced. The patient died suddenly and easily the next day from what Dr. Smith concluded to be paralysis of the heart.

*Case 121.*—October 2d, 1887. Courtesy Dr. Holman, of Englewood. Termination, recovery. Age, four years. Diphtheritic. The child coughed up the tube on the third day and swallowed it. It was passed three days later per rectum. The dyspnoea did not return and the patient made a good recovery.

*Case 122.*—October 5th, 1887. Courtesy Dr. Holman, of Englewood. Termination, fatal. Age, twenty-two months. Diphtheritic and sister to case 121. The patient had suffered from pharyngeal and nasal diphtheria for sev-

eral days when the larynx became involved. Great and immediate relief followed the operation, but the baby died three days later from extension of the diphtheritic membrane of the bronchial tubes.

*Case 123.*—October 7th, 1887. Courtesy Dr. Dyas. Termination, recovery. Age, nine years. The child had been sick for one week with a severe form of pharyngeal diphtheria. The larynx had been invaded for three days, and the patient was dying from dyspnoea. Nourishment was taken freely and the tube not removed until the fifth day. Recovery was perfect.

*Case 124.*—October 10th, 1887. Courtesy Dr. McCarthy. Termination, fatal. Age, seven years. A very severe form of diphtheria and the child died thirty-six hours after the operation from exhaustion.

*Case 125.*—October 21st, 1887. Courtesy Dr. McCarthy. Age, five years. A case of membranous croup. No membrane was seen at any time in the pharynx, and no severe constitutional symptoms were present. The danger was simply from suffocation. Membrane was ejected when the tube was introduced. The tube was removed on the third day, and still more membrane was ejected. The tube was again introduced, and on the following day it was coughed up, when it was no longer needed.

*Case 126.*—October 21st, 1887. Courtesy Dr. Cook. Termination, fatal. Age, six and a half years. Membranous croup. No evidence of diphtheria. Child died suddenly a few hours after the operation, probably from detachment of membrane below the tube.

*Case 127.*—October 23d, 1887. Courtesy Dr. J. G. Berry. Termination, fatal. Age, six and a half years. Membranous

croup. The people were poor, lived in crowded quarters, and although the patient was at all times surrounded by the other children of the family, yet none of them manifested any symptoms of diphtheria. Much difficulty was encountered in obtaining the consent of parents to the operation. The child was greatly prostrated and the nursing was most careless and unsatisfactory. The operation was finally permitted. On the second day the tube was coughed up and swallowed. The dyspnoea again became so urgent that another tube was introduced. On the fourth day the child was so exhausted, little or no nourishment having been taken, that it was considered imperative to remove the tube, but the parents would not give their consent, fearing that the child would "choke up" again, and begged to have it left in until the next day, as it was so comfortable. The child died during the night from exhaustion. *It should have recovered.*

*Case 128.*—October 25th, 1887. Courtesy Dr. ——. Termination, fatal. Age, four years. Diphtheritic. The usual relief followed the operation. The tube was removed after two days and a large membranous cast of trachea was expelled. It was necessary to replace the tube and the child died the next day from reformation and extension of the membrane.

*Case 129.*—November 2d, 1887. Courtesy Dr. Casely. Termination, fatal. Age, four and one-half years. Child greatly prostrated by diphtheria. After the larynx became involved no nourishment was taken and the patient became extremely weak. The child revived after the operation and took nourishment fairly well. The tube was removed on the third day and the child died within an hour from exhaustion.

*Case 130.*—November 7th, 1887. Courtesy Dr. Nelson. Age, three years. Diphtheritic. The child coughed the tube up thirty-six hours after its introduction and was again laboring desperately until its reintroduction. The tube was removed two days later, but it became necessary to again introduce it within an hour. The tube was again removed on the sixth day, when it was no longer required.

*Case 131.*—November 24th, 1887. Courtesy Dr. Church. Termination, fatal. Age, two years. Diphtheritic. Bronchial tubes already invaded and only partial relief followed the operation. Patient died thirty-six hours later from bronchial exudation.

*Case 132.*—November 24th, 1887. Courtesy Dr. Dahlberg. Termination, fatal. Age, one year. Diphtheritic. The patient was a nursing infant and would have lived but a few hours without relief. The tube was removed on the fourth day, but it became necessary to again introduce it twelve hours later. The patient died on the sixth day from bronchial obstruction.

*Case 133.*—December 4th, 1887. Courtesy Drs. Sanders and Mannheimer. Termination, recovery. Age, four years. Diphtheritic, and child in extremis from laryngeal obstruction. When the tube was introduced, membrane was crowded down ahead of it, and the child could not breath. The tube was at once withdrawn, and a strip of false membrane was ejected. In an hour the dyspnoea again returned, and the tube was once more introduced. Although the dyspnoea was greatly lessened, yet the relief was not complete. There evidently was membrane below the tube. A steam atomizer was constantly used, and the patient watched very closely. On the third day the membrane became detached, the child taken with a choking spell, and

expelled the tube together with membrane. A good recovery resulted.

*Case 134.*—December 7th, 1887. Courtesy Drs. Steele and Babcock. Termination, fatal. Age, two and a half years. Diphtheritic. Death occurred two days after the operation, from extension of membrane into smaller bronchi.

*Case 135.*—December 8th, 1887. Courtesy Dr. Merckle. Termination, fatal. Age, thirteen years. All the children in the family, which was a large one, were sick with diphtheria. In this case it extended into the larynx, and the child suffered from the most frightful dyspnoea. The operation gave entire relief, but the patient died of diphtheritic toxæmia two days later.

*Case 136.*—December 23d, 1887. Courtesy Dr. Riley. Termination, fatal. Age, nine years. Malignant diphtheria, with invasion of the larynx. The uvula, tonsils, posterior wall of pharynx, and nasal passages covered with diphtheritic membrane. The operation gave entire relief to the urgent dyspnoea, but the temperature continued high, and the pulse rapid and feeble. The child died two days after the operation, from sepsis.

*Case 137.*—December 26th, 1887. Courtesy Dr. Thomas. Termination, fatal. Age, three years. Diphtheritic. The operation gave immediate relief to the difficult breathing. The patient died on the second day, from extension of membrane into bronchi.

*Case 138.*—December 27th, 1887. Courtesy Drs. Gatchell and Mitchell. Termination, fatal. Age, three years. The patient was convalescing from a mild attack of diphtheria when symptoms of croup occurred. The dyspnoea gradually increased until it became necessary to perform intubation. Twenty four hours after the operation the

tube was ejected. An hour later another was introduced. Two days after the operation the respiration and cough indicated the presence of membrane below the tube. Fearing sudden detachment and immediate suffocation the tube was removed and after strangling, coughing and struggling violently, and as we were about to introduce the trachea forceps, a large mass of false membrane was ejected. This proved to be a perfect membranous cast of the trachea and larger bronchial tubes. The return of dyspnoea necessitated the use of the tube within an hour. Twelve hours later there was partial detachment of membrane below the tube and the child at once became asphyxiated. The tube was removed, but the child could not expel the membrane. The trachea forceps was introduced and a strip of membrane two inches in length removed and the child revived. In an hour the breathing again became difficult and the tube was introduced. The child died the next day from extension of membrane into the bronchial tubes.

*Case 139.*—December 28th, 1887. Courtesy Dr. Gfroerer. Termination, fatal. Age, two years. Diphtheritic. The child died the next day from capillary bronchitis.

*Case 140.*—December 31st, 1887. Courtesy Dr. Skyles. Termination, fatal. Age, ten years. Malignant diphtheria. The patient died the next day from diphtheritic toxæmia.

*Case 141.*—January 1st, 1888. Courtesy Dr. Jacques. Termination, fatal. Age, three years. A diphtheritic case; another child in the family had just died from diphtheria. Although the child was in extremis it revived after the operation, and did well for two days, when the breathing and a peculiar, hoarse cough indicated the pres-

ence of partially detached membrane below the tube. The tube was removed and a perfect membranous cast of the trachea expelled. In a few hours it became necessary to again introduce the tube. The membrane rapidly reformed and extended into the bronchial tubes, the child dying two days later.

*Case 112.*—January 3d, 1888. Courtesy Dr. Boas. Termination, fatal. Age, six years. Malignant diphtheria, with invasion of the larynx. The operation gave relief, but the child died on the third day, from sepsis and exhaustion.

*Case 113.*—January 28th, 1888. Courtesy Dr. Dietrich. Termination, recovery. Age, three years. The child was suffering from whooping cough when taken with diphtheria. The larynx became invaded, the child greatly exhausted, and the urine loaded with albumen. It seemed a hopeless case. The operation gave relief, and the tube was worn three days, when it was no longer required.

*Case 114.*—February 9th, 1888. Courtesy Dr. Quine. Termination, fatal. Age, four years. Diphtheritic. The patient a few months previously, suffered from a severe attack of nephritis, from which it never fully recovered. Subsequently it had an attack of scarlet fever, and the nephritis was greatly aggravated. When recovering from the scarlet fever, diphtheria made its appearance, the larynx became invaded, and intubation was performed to prevent suffocation. The urine was loaded with albumen, and almost entirely suppressed. After wearing the tube two days, it was considered best to remove it, as the child was frantic from thirst, and on doing so a large cast of the trachea was expelled. It became necessary, however, to again relieve the returning dyspnea, and a tube with the metal epiglottis was employed, and although there was a great contrast in

the ability of the patient to swallow liquids with this tube, it died about eight hours later from uræmia.

*Case 145.*—February 16th, 1888. Courtesy Dr. Parsons. Termination, fatal. Age, four years. A malignant case of diphtheria, with invasion of the larynx. The child was unwilling to take food either before or after the operation, and was greatly exhausted. The tube with metal epiglottis was employed, and the child swallowed well when it could be induced to make the effort. The spring regulating the action of the artificial epiglottis gave way on the second day, and the child was taken suddenly with suffocation. The tube was at once extracted, and the patient revived, but died, however, during the night, from the malignancy of the disease.

*Case 146.*—February 17th, 1888. Courtesy Dr. Roberts, of Lemont. Termination, recovery. Age, two years. A case of membranous croup. No membrane was visible in the pharynx, but the dyspnea from laryngeal obstruction was intense and the child could have lived but a short time. The tube with the metal epiglottis was used and the child was able to swallow liquids with great comfort. The tube was coughed up on the third day and the patient made an excellent recovery.

*Case 147.*—February 19, 1888. Courtesy Dr. Kauffman, of Blue Island. Termination, fatal. Age, five years. The new tube with metal epiglottis again employed. The child swallowed far better than children usually do with the open tube. The tube was removed on the third day, but the bronchial tubes were invaded and the child died during the following night. A diphtheritic case.

*Case 148.*—February 27th, 1888. Courtesy Drs. Rea and Roller. Termination, fatal. Age, eighteen months.

Diphtheritic. Another child in the family had just died from diphtheria. The dyspnoea from laryngeal obstruction was urgent and the patient was much exhausted. The patient died suddenly on the third day, probably from obstruction below the tube. The old style of tube was used.

*Case 149.*—March 2d, 1888. Courtesy Dr. B. D. Foster. Termination, recovery. Age, five years. Diphtheritic. The new tube with artificial epiglottis was employed and the patient swallowed fluids admirably. The comfort of this patient, with the ability to have an unstinted supply of fluids, contrasted greatly with the suffering of previous patients who were denied this privilege on account of their inability to swallow without violent coughing. This patient coughed up the tube on the second day. For three days the child was comfortable, when the membrane again forming, it was necessary to replace the tube, on doing which a large membranous cast was expelled. The tube was worn for three days with perfect comfort, when it was removed and the patient made a rapid recovery. In this case the urine was loaded with albumen.

*Case 150.*—March 5th, 1888. Courtesy Drs. Whitman and Holman, of Englewood. Termination, fatal. Age, two years. This was a diphtheritic case and the child was greatly exhausted. The new tube was used. The patient died twelve hours after the operation from extension of membrane below the tube.

## SUMMARY.

5 cases were under 1 year			with 1 recovery	or 20.00 per cent.
17	"	" between 1 and 2 years,	" 4 recoveries	" 23.52 "
29	"	" 2 "	3 " 5 "	" 17.24 "
25	"	" 3 "	4 " 5 "	" 20.00 "
28	"	" 4 "	5 " 10 "	" 35.71 "
13	"	" 5 "	6 " 6 "	" 46.15 "
10	"	" 6 "	7 " 2 "	" 20.00 "

10 cases were between 7 and 8 years, with 2 recoveries or 20.00 per cent.

4	"	"	8	"	9	"	3	"	"	75.00	"	"
4	"	"	"	9	"	10	"	"	3	"	"	75.00
2	"	"	"	10	"	11	"	"	0	"	"	00.00
1	"	"	"	12	"	13	"	"	0	"	"	00.00
1	"	"	"	13	"	14	"	"	0	"	"	00.00
1	"	"	"	14	"	15	"	"	0	"	"	00.00

Total, 150.

Recoveries, 41.

Per centage of recoveries, 27.33.

Average age of all cases, three years, eleven months and three days.

Average of those recovering, four years, three months and twenty-four days.

Average of fatal cases, three years, eight months and seventeen days.

These patients were seen in the following months:

January	-----	17 cases.	July	-----	6 cases.
February	-----	11 "	August	-----	6 "
March	-----	15 "	September	-----	12 "
April	-----	9 "	October	-----	17 "
May	-----	12 "	November	-----	19 "
June	-----	7 "	December	-----	19 "

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The following one hundred cases were reported by Dr. J. O'Dwyer, of New York; the first fifty appearing in the *Medical Record* of October 29th, 1887, and the second fifty in the *New York Medical Journal* of January 14th, 1888.

These cases were treated by Dr. O'Dwyer, in his private practice, carefully reported, and do not include sixty-five hospital and experimental cases, that also occurred in his practice. These statistics, while they do not vary much from my own, add one hundred cases to the record, thus enabling the reader to better determine the value of the operation, and are for this reason too valuable to be omitted.

Number.	Date.	In consultation with,	Sex.	Age.	Duration before intuba-	
					tion of	
					Pharyngeal	diphtheria,
1885.						
1 Dec.	5	Own case.....			E.	3 yrs, 3 mos, 2 days ... 1 day .....
2 "	7	Drs. B. E. Hayes and J. L. Smith.....			F.	14 months... Several days
3 "	10	Drs. Stubenbord & Winters.....			M.	18 months ... 1 day ... 4 days .....
4 "	30	Dr. Northrup.....			F.	3 yrs, 4 mos, 5 days ... 4 days .....
1886.						
5 Feb.	1	Dr. J. Lewis Smith.....			M.	2 yrs, 3 mos, 3 days ... None .....
6 March	23	Dr. J. J. Reid.....			M.	5 years..... 3 days ... 3 days .....
7 April	6	Dr. W. A. Hawes.....			M.	3 yrs, 1 mo., 2 days ... 7 days .....
8 "	22	Dr. J. Lewis Smith.....			M.	2 yrs, 5 mos, 1 day ... Several days
9 May	1	My own case.....			F.	3 yrs, 9 mos, 1½ day ... None .....
10 "	14	Drs. L. L. Bradshaw and F. Lange.....			F.	3 yrs, 2 mos, 1½ day ... Next day .....
11 "	15	Dr. Alex. Hadden.....			F.	6 years..... 2 days ... Several days
12 "	18	Drs. M. M. Dunton and J. D. Bryant.....			F.	7 years..... 3 days ... Not noted...
13 "	21	Dr. J. R. Cyvert.....			M.	3 yrs, 3 mos, 4 days ... 1 week .....
14 "	25	Dr. J. Oppenheim.....			F.	18 months... 2 days ... Several days
15 June	5	Dr. Hodgman.....			F.	3 yrs, 6 mos, 2 days ... Several days
16 "	11	Dr. W. E. Bullard.....			M.	2 yrs, 6 mos, 1 day ... Few hours..
17 "	24	Dr. W. A. Hawes.....			F.	2 yrs, 6 mos, 1 day ... 2 days .....
18 July	1	Dr. W. A. Hawes.....			M.	1 yrs, 2 mos, 1 day ... 3 days .....
19 "	7	Dr. J. R. Cyvert.....			M.	23 months... 1 day ... 1 day .....
20 "	16	Dr. C. J. Macguire.....			M.	5 yrs, 6 mos, 2 days ... Next day .....
21 "	19	Dr. H. B. Sorague.....			M.	1 years..... 2 days ... Several days
22 "	22	Dr. B. Hughes.....			M.	7 years..... 7 days ... 4 days .....
23 "	23	Dr. R. B. Burton.....			F.	4 yrs, 6 mos, 2 days ... Several days
24 "	26	Dr. R. B. Burton.....			F.	3 yrs, 1 mo., 2 days ... 4 days .....
25 Aug.	19	Dr. John Gleises.....			M.	4 yrs, 8 mos, 2 days ... 2 days .....
26 Sept.	19	Dr. Hermann.....			F.	2 years..... 26 hours ... Several days
27 "	19	Dr. C. W. Bohnfalk.....			M.	5 yrs, 10 mos, 1 day ... 2 days .....
28 "	26	Dr. H. J. Boldt.....			F.	4 yrs, 4 mos, 3 days ... 5 days .....
29 Oct.	10	Dr. J. P. Nolan.....			F.	3 years..... 2 days ... None .....
30 "	12	Dr. J. M. F. Egan.....			F.	6 yrs, 7 mos, 2 days ... None .....
31 Nov.	6	Dr. Daniel Lewis.....			F.	3 yrs, 2 mos, 2 days ... Several days
32 "	8	Dr. S. Hemingway.....			M.	2 yrs, 11 mos, 36 hours ... None .....
33 "	11	Dr. J. R. Cyvert.....			M.	5 yrs, 6 mos, 3 days ... 4 days .....
34 "	15	Dr. T. Brickerton.....			F.	18 months... 12 hours ... 2 days .....
35 "	23	Drs. Offenbach & I. Adler.....			F.	4 years..... 1 day ... 1 day .....
36 "	26	Dr. Berghaus.....			F.	6 yrs, 11 mos, 4 days ... 7 days .....
37 "	26	Dr. Jos. Winters.....			F.	20 months... 4 days ... 3 days .....
38 "	28	Dr. R. B. Burton.....			M.	2 yrs, 11 mos, 3 days ... 5 days .....
39 "	29	Dr. J. W. Ranney.....			F.	15 months... 6 days ... 9 days .....
40 "	28	Dr. J. Lewinthal.....			F.	20 months... 1 day ... 3 days .....
41 Dec.	1	Drs. R. G. Wiemer and L. Conrad.....			M.	11 years..... 2 days ... 4 days .....
42 "	3	Dr. M. J. Fleming.....			M.	5 years..... 2 days ... None .....
43 "	4	Dr. W. A. Ewing.....			M.	2 yrs, 6 mos, 7 days ... None .....
44 "	5	Dr. J. Lewis Smith.....			M.	2 years..... 3 days ... 6 days .....
45 "	5	My own case.....			M.	3 yrs, 5 mos, 1 day ... 2 days .....
46 "	7	Dr. A. H. Fridenberg.....			M.	3 yrs, 2 mos, 7 days ... 7 days .....
47 "	8	Dr. B. Hughes.....			F.	10 months... 1 day ... 2 days .....
48 "	10	Dr. W. G. Robinson.....			M.	6 yrs, 2 mos, 7 days ... 3 days .....
49 "	14	Dr. R. J. O'Connell.....			M.	8 years..... 36 hours ... 3 days .....
50 "	16	Drs. Pierson & Eisner.....			M.	4 years..... 2 days ... 4 days .....
51 "		Drs. Wallace & McLoughlin			F.	9 years..... 2 days ... 10 days .....

Urine.	Cause of death.	Complications before intubation.	Result.
Not exam.	Extension to bronchi		Died 2 days after intubation.
Not exam.	Exhaustion		Died 6 hrs. after intubation.
Not exam.	Extension to bronchi		Died 7 hrs. after intubation.
Albumen	Extension to bronchi		Died 2 days 10 hrs. after intubation.
Albumen	Nephritis		Died 8 days 3 hrs. after intubation.
Albumen	Uremic convulsions		Died 1 day 9 hrs. after intubation.
Albumen	Suppression of urine		Died 4 days 1½ hrs. after intubation.
Not exam.	Exhaustion		Died 36 hrs. after intubation.
Albumen	Septicæmia		Died 6 hrs. after intubation.
Not exam.	Pneumonia		Died 5 days 8½ hrs. after intubation
No albumen	Exhaustion	Following scarlet fever	Died 5 days after intubation.
Not exam.	Pneumonia	Pneumonia when tube was inserted	Died 18 hrs. after intubation.
Not exam.			Recovered. Tube worn 4 days.
Not exam.	Extension to bronchi		Died 2 days after intubation.
Not exam.	Convulsions		Died 1 day 8 hrs. after intubation.
Not exam.	Extension to bronchi		Died 2 days 6½ hrs. after intubation.
Not exam.	Convulsions; sepsis		Died 1 day 8 hrs. after intubation.
Albumen			Recovered. Tube worn 4 d. 18½ hrs.
Albumen	Extension to bronchi		Died 3 days 7 hrs. after intubation.
Albumen	Exhaustion		Died 2 days 10½ hrs. after intubation.
Albumen			Recovered. Wore tube 5 days 6 hrs.
Not exam.			Recovered. Wore tube 3 days.
Albumen	Uremia		Died 1 day 22½ hrs. after intubation.
Albumen	Ex'n & pneumonia		Died 7 days after intubation.
Not exam.	Extension to bronchi		Died 2 days after intubation.
Not exam.	Extension to bronchi		Died 13 hrs. after intubation.
Not exam.	Exhaustion		Died 1 day 14½ hrs. after intubation.
Not exam.			Recovered. Wore tube 4 days 8 hrs.
Albumen	Extension to bronchi		Died 2 days 9½ hrs. after intubation.
Albumen	Pneumonia 25 hrs. after removal of tube	Bronchitis	Died 3 days 20 hrs. after intubation.
Albumen	Nephritis; œdema of lungs		Died 4 days 22½ hrs. after intubation.
None			Recovered. Wore tube 5 days.
Not exam.	Extension to bronchi		Recovered. Wore tube 6 hrs.
None			Died 15 hrs. after intubation.
Albumen	Sepsis		Recovered. Wore tube 10 days 6 hrs.
Not exam.			Died 1 day 4 hrs. after intubation.
Albumen	Extension to bronchi		Died 36 hrs. after intubation.
Not exam.		Measles	Died 2½ days after intubation.
Not exam.	Extension		Recovered. Wore tube 9 days.
Not exam.			Died 2 days after intubation.
Albumen	Œdema of lungs		Died 12 hrs. after intubation.
Albumen			Recovered. Wore tube 6 days.
	Broncho-pneumonia		Died 2 days after intubation.
	Extension		Died 1 day 20 hrs. after intubation.
None	Extension		Died 2 days 9 hrs. after intubation.
Not exam.	Extension		Recovered. Wore tube 6 days 19 hrs.
Not exam.	Extension		Died 1 day 14 hrs. after intubation.
None			Died 19½ hrs. after intubation.
Albumen	Extension		Recovered. Wore tube 2 days 9 hrs.
Not exam.	Inanit'n, paralysis		Died 2 days 22 hrs. after intubation.
			Died 3 weeks after removal of tube.

Number	Date.	In consultation with.	Sex.	Age.	Duration before intuba-		
					bation of	Croup.	Pharyngeal diphtheria.
1886.							
52 Dec.	1875.	My own case .....	M.	3 yrs, 3 mos, 1 day .....	Present .....		
53 Jan.		Dr. O. P. Honegger .....	F.	6 yrs, 5 mos, 1 $\frac{1}{2}$ day .....	Present .....		
54 "		Dr. J. M. F. Egan and Dr. J. P. Daly .....	M.	3 yrs, 5 mos, 1 day .....	Present .....		
55 "		Dr. B. G. Cook .....	F.	3 yrs, 4 mos, 1 day .....	Present .....		
56 "		Dr. J. F. Holmes .....	M.	4 $\frac{1}{2}$ years .....	3 days .....	Present .....	
57 "		Dr. J. F. Holmes .....	F.	2 yrs, 10 mos, 1 $\frac{1}{2}$ day .....	Present .....		
58 "		Dr. J. H. Dew .....	M.	3 $\frac{1}{2}$ years .....	1 day .....	Present .....	
59 Feb.		Dr. Gluck .....	M.	4 $\frac{1}{2}$ years .....	1 $\frac{1}{2}$ day .....	None .....	
60 "		Dr. Hemingway .....	F.	2 $\frac{1}{2}$ years .....	15 hours .....	3 days .....	
61 "		Dr. Conrad Lange .....	M.	2 yrs, 8 mos, 4 days .....	5 days .....		
62 Mar.		Dr. J. Lewengood and Dr. P. W. Cremin .....	M.	3 $\frac{1}{2}$ years .....	3 days .....	6 days .....	
63 "		Dr. G. C. H. Meier .....	F.	2 $\frac{1}{2}$ years .....	1 day .....	None .....	
64 "		Dr. Robert Milbank .....	F.	5 years .....	2 days .....	None .....	
65 "		Dr. Feigenblatt and Dr. Conrad .....	M.	18 months .....	1 $\frac{1}{2}$ day .....	4 days .....	
66 "		Dr. Janvrin and Dr. C. E. Billington .....	F.	4 months .....	2 days .....	7 days .....	
67 "		Dr. S. Meltzer .....	F.	8 yrs, 9 mos, 1 day .....	7 days .....		
68 "		Dr. J. T. Deyo .....	M.	3 yrs, 7 mos, 2 weeks .....	2 weeks .....		
69 April		Dr. H. Herrenmann .....	M.	23 months .....	3 days .....	1 day .....	
70 "		Dr. R. B. Burton .....	M.	2 yrs, 2 mos, 3 days .....	None .....		
71 "		Dr. E. Elliot & Dr. A. Jacobi .....	F.	19 months .....	3 days .....	None .....	
72 "		Dr. Berghausen .....	F.	4 years .....	3 days .....	10 days .....	
73 May		Dr. P. W. Cremin .....	F.	4 yrs, 9 mos, 3 days .....	3 days .....		
74 "							
75 "		Dr. H. Bosch .....	M.	5 yrs, 9 mos, 1 day .....	4 weeks .....		
75 "		Dr. L. Burghheim .....	M.	7 yrs, 1 mo, 12 hours .....	None .....		
76 "		Dr. Rudisch .....	F.	3 yrs, 1 mo, 1 $\frac{1}{2}$ day .....	14 days .....		
77 "		Dr. Blever and Dr. Reid .....	M.	3 years .....	1 $\frac{1}{2}$ day .....	None .....	
78 "		Dr. J. F. Curry .....	M.	4 yrs, 9 mos, 3 days .....	4 days .....		
79 "		Dr. J. Baran .....	F.	4 yrs, 8 mos, 1 day .....	3 days .....		
80 "		Dr. V. Mravag and Dr. J. S. Green <sup>4</sup> .....	M.	3 yrs, 2 mos, 2 days .....	5 days .....		
81 "		Dr. Vedder and Dr. Wilcox .....	M.	7 $\frac{1}{2}$ years .....	1 $\frac{1}{2}$ day .....	2 days .....	
82 July		Dr. W. B. Anderton and Dr. A. J. Magnin .....	M.	2 yrs, 5 mos, 12 hours .....	2 days .....		
83 "		Dr. E. Sanders .....	M.	2 yrs, 5 mos, 1 day .....	2 days .....		
84 "		Dr. R. Stein .....	F.	16 months .....	1 day .....	2 days .....	
85 Sept.		Dr. J. M. F. Egan .....	F.	4 years .....	1 days .....	12 days .....	
86 Oct.		Dr. L. Conrad .....	F.	5 $\frac{1}{2}$ years .....	2 days .....	1 days .....	
87 "		Dr. A. H. Goelet .....	M.	4 yrs, 5 mos, 3 days .....	Present .....		
88 "		Dr. Gluck & Dr. Holthusen .....	M.	5 years .....	2 days .....	None .....	
89 "		Dr. G. M. Vandegraft .....	M.	2 years .....	12 hours .....	6 days .....	
90 "		My own case .....	M.	5 years .....	1 $\frac{1}{2}$ day .....	Present .....	
91 Nov.		Dr. Daniel Lewis .....	F.	1 yrs, 3 mos, 3 days .....	None .....		
92 "		Dr. W. G. Robinson .....	F.	5 years .....	1 week .....	1 day .....	
93 "		Dr. P. H. Pyne <sup>5</sup> .....	F.	5 $\frac{1}{2}$ years .....	3 days .....	Present .....	
94 "		Drs. J. B. & B. C. McIntyre .....	M.	22 months .....	1 $\frac{1}{2}$ day .....	1 $\frac{1}{2}$ day .....	
95 "		Dr. W. N. Guernsey .....	F.	1 yrs, 2 mos, 2 days .....	3 days .....		
96 "		Dr. H. J. Schiff .....	F.	3 yrs, 2 mos, 2 days .....	Present .....		
97 "		Dr. A. Hodgman .....	M.	6 yrs, 7 mos, 3 days .....	10 days .....		
98 "		Dr. C. E. Nimmack .....	M.	3 years .....	2 days .....	1 days .....	
99 "		Dr. C. H. Grube .....	F.	1 years .....	1 day .....	2 days .....	
100 "		My own case .....	M.	9 years .....	2 days .....	Several days .....	

Urine.	Cause of death.	Complications before intubation.	Result.
No albumen	Extension to bronchi		Died 3 days 21 hrs, after intubation.
Not exam.	Extension to bronchi		Died 5 days 2 hrs, after intubation.
Albumen	Not known		Died 4 days 14 hrs, after intubation.
Albumen	Sepsis	A hopeless, septic case	Died 17 hrs, after intubation.
Albumen	Pneumonia		Died 9 days after intubation.
Albumen	Extension to bronchi	Extensive pneumonia, measles	Died 1 day 4 hrs, after intubation.
Not exam.	Pneumonia		Died 62 hrs, after intubation.
Not exam.	Extension to bronchi		Died 16½ hrs, after intubation.
Not exam.	Extension to bronchi		Died 14½ hrs, after intubation.
Albumen	Pneumonia		Died 9 days after intubation.
Albumen			Recovered. Wore tube 1 day 1 hour.
Not exam.	Extension to bronchi		Died 1 day after intubation.
Albumen			Recovered. Wore tube 6 days.
No albumen			Recovered. Wore tube 4 days 4 hrs.
Not exam.	Broncho-pneumonia		Died 1 day 10 hrs, after intubation.
Not exam.	Exhaustion		Died 1½ day after intubation.
No albumen			Recovered. Wore tube 3 days 21 hrs.
Not exam.	Extension to bronchi		Died 1 day after intubation.
No albumen	Extension to bronchi		Died 2 days after intubation.
Albumen	Asthenia		Died 2 days 2½ hrs, after intubation.
Albumen	Ext'n & nephritis		Died 2 days 4 hrs, after intubation.
Albumen	Nephritis, & exhaustion		Died 7 days after intubation.
Albumen		Scarlet fever with diphtheria	
Albumen		4 weeks before	Recovered. Wore tube 4 days 10 hrs.
No albumen			Recovered. Wore tube 4 days 10 hrs.
Not exam.	Ext'n & pneumonia		Died 2 days 5 hrs, after intubation.
Not exam.	Extension to bronchi		Died 1½ day after intubation.
Not exam.	Heart failure	Sepsis	Recovered. Wore tube 4 days.
Albumen	Ext'n & pneumonia		Died 17 hrs, after intubation.
Albumen	Nephritis, pneumo.		Died 1 day 18 hrs, after intubation.
Not exam.	Ext'n & pneumonia		Died 22 hrs, after intubation.
Not exam.	Pneumonia		Died 8 days 19½ hrs, after intubation.
Not exam.	Extension to bronchi		Died 26 hrs, after intubation.
Albumen	Convulsions, ext'n,		Died 1 day 22½ hrs, after intubation.
Albumen	Ext'n, nephritis, sepsis		Died 1 day 13 hrs, after intubation.
Albumen			Recovered. Wore tube 10 days.
No albumen			Recovered. Wore tube 5 days.
Not exam.	Ext'n & pneumonia		Recovered. Wore tube 3 d. 19½ hrs.
Albumen	Ext'n & pneumonia		Died 6 days 18 hrs, after intubation.
No albumen			Recovered. Wore tube 6 days 6 hrs.
Not exam.	Exhaustion		Died 1 day after intubation.
Albumen			Recovered. Wore tube 7 d. 21½ hrs.
Not exam.			Recovered. Wore tube 6 days 21 hrs.
Albumen	Sepsis, extension		Died 1 day after intubation.
Albumen	Double pneumonia		Died 9 days 21 hrs, after intubation.
Albumen	Exhaustion		Recovered. Wore tube 3 days 9 hrs.
Not exam.	Extension to bronchi	Sup. of urine	Died 3 days 8 hr, after intubation.
Albumen			Died 2 days 9 hrs, after intubation.
			Recovered. Wore tube 4½ days.

## INTUBATION OF THE LARYNX.

No.	Age.	Recoveries.	No.	Age.	Recoveries.
1	0 years 10 months.	0	1	3 years 6 months.	0
1	1 " 2 "	0	1	3 " 9 "	0
1	1 " 3 "	1	3	1 " 0 "	2
3	1 " 6 "	0	1	1 " 2 "	1
2	1 " 8 "	0	1	1 " 4 "	1
1	1 " 11 "	0	1	4 " 6 "	0
2	2 " 0 "	0	1	4 " 8 "	0
1	2 " 3 "	0	2	5 " 0 "	1
1	2 " 5 "	0	2	5 " 6 "	0
3	2 " 6 "	0	1	5 " 10 "	0
2	2 " 10 "	1	1	6 " 0 "	0
1	3 " 0 "	0	1	6 " 2 "	0
2	3 " 1 "	0	1	6 " 5 "	0
3	3 " 2 "	1	1	6 " 11 "	0
2	3 " 3 "	1	2	7 " 0 "	1
1	3 " 4 "	0	1	8 " 0 "	1
1	3 " 5 "	0	1	11 " 0 "	0

Males, 27; females, 23. Total, 50. Recoveries, 12. Average age, two years and nine months.

No.	Age.	Recoveries.	No.	Age.	Recoveries.
1	0 years 4 months.	0	2	3 years 6 months.	1
1	1 " 4 "	0	1	3 " 7 "	1
1	1 " 6 "	1	3	1 " 0 "	0
1	1 " 7 "	0	1	4 " 2 "	0
1	1 " 10 "	1	2	4 " 5 "	2
1	1 " 11 "	0	2	4 " 6 "	0
1	2 " 0 "	1	1	1 " 8 "	0
1	2 " 2 "	0	2	1 " 9 "	1
2	2 " 5 "	0	4	5 " 0 "	2
2	2 " 6 "	0	2	5 " 6 "	1
1	2 " 8 "	0	1	5 " 9 "	1
1	2 " 10 "	0	1	6 " 5 "	0
2	3 " 0 "	0	1	6 " 7 "	1
1	3 " 1 "	0	1	7 " 1 "	1
2	3 " 2 "	0	1	7 " 6 "	0
1	3 " 3 "	0	1	8 " 9 "	0
1	3 " 4 "	0	2	9 " 0 "	1
1	3 " 5 "	0	50		15

Total, 50; males, 25; females, 23; not stated, 2; recoveries, 15, or 30 per cent. Average age of patients that recovered, 4 years 8 months; of patients that died, 3 years 9 months.

In this connection, it may be interesting to refer to a case of bronchocele which produced death by pressure on the trachea. The patient was a girl fourteen years old. She had been suffering with a goiter for about a year, which had rapidly increased in size. The parents observed that at times it was larger than at others, more particularly after she had taken cold; but still, it gave no particular inconvenience until three days before death, when it was stated that she had taken cold and the tumor had suddenly become larger. With the increased size of the bronchocele, firmly pressed against the trachea, from its position under the sterno-thyroid muscles, great dyspnoea resulted. The patient was



Fig. 44. Author's tube for bronchocele.

attended by Dr. J. G. Berry, who recognized the true condition, and on the third day I was called to perform intubation. The child was now in a most desperate condition; indeed, she was moribund, the pulse was feeble, rapid and thready; hypostatic congestion had already occurred in the lungs, and she was semi-comatose.

While in this condition, the largest size intubation tube was introduced, but it failed to give relief, as it was not of sufficient length. It would not reach through the stricture, and from the pressure

of the enlarged gland as rapidly as it was pressed down into position, just so rapidly would it be pressed up again. The child was so near dead that tracheotomy was thought to be useless. To meet such emergencies as this, I have had a much longer tube constructed (Fig. 44), one that will pass entirely

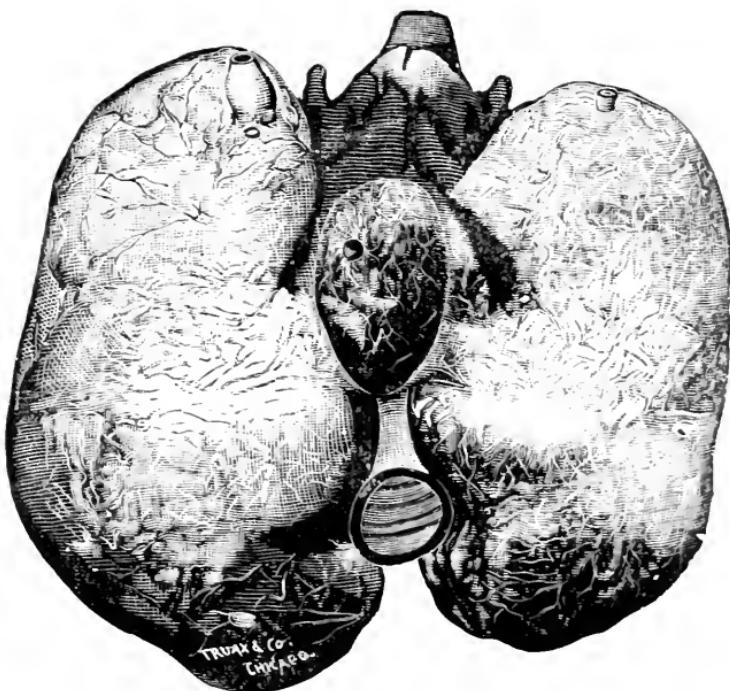


Fig. 45. Case of Bronchocele.

through such a stricture, and consequently give entire relief.

The object in performing intubation in cases of bronchocele is to give immediate relief, and to give time in which to reduce the tumor by electrolysis or the internal and external use of iodine; or, these

measures failing, the physician might then leisurely enucleate the gland. Bronchocele may produce death by pressure laterally, or by suffocation from pressure upon the trachea anteriorly; or a lobe of the gland may develop between the trachea and œsophagus, and produce pressure posteriorly. In this case the pressure was exerted laterally (Fig. 45). Had I possessed the tube illustrated by Figure 44, this patient's life might have been saved.

## CHAPTER VII.

### THE COMPARATIVE VALUE OF INTUBATION AND TRACHEOTOMY IN THE TREATMENT OF PSEUDO-MEMBRANOUS LARYNGITIS.

To those who have carefully investigated the respective merits of intubation and tracheotomy, it must be evident that the former possesses quite a number of advantages, among the more important of which the following may be briefly summarized:

1. The operation is admissible among the poor, where poverty and unfavorable surroundings would preclude tracheotomy. It is an admitted fact that the after treatment of tracheotomy has a most important bearing upon the result, and that if it is impossible to give the patient the most careful attention and skillful nursing, it is useless to operate. While the care and proper after-treatment has much to do with the result after intubation, yet it is not in many cases imperative to have a skilled attendant constantly present.
2. The skillful operator can perform the operation quickly, almost instantly, without shock and without loss of blood.

3. No anaesthetic is required in performing the operation.
4. There is no injury to the soft tissues, and little or no pain accompanying it.
5. There is no open wound and no danger from erysipelas or septicaemia.
6. There is but little irritation from the tube, it being much less than from a tracheotomy tube.
7. There is no wound to close by slow granulation.
8. The air enters the lungs through the natural passages, is warm and moist, and there is consequently no drying of mucus in the tube, and no cleansing is required. Should the tube become partially obstructed, it will almost invariably be expelled.
9. Recovery is rapid after the removal of the tube. We do not witness the long delays that frequently follow after tracheotomy, due to granulations about the wound, adhesion of the opposing surfaces of the vocal cords, or retention of membrane in the larynx, occasionally remaining for weeks or months.
10. A very important consideration is the fact that consent to the operation may be more easily obtained, and physicians can save a great many patients where tracheotomy would not be allowed.
11. While the ten reasons above given ought to be sufficient to convince even those prejudiced against intubation, that it possesses merits not found

in tracheotomy, there still remains a stronger and more vital argument in its favor, which, to my mind, alone outweighs all that can be said in favor of the latter. A comparison of statistics clearly demonstrates that by intubation we can save as large a per centage of cases at all ages, and a much larger proportion under the age of three years, and if all the reasons before given be deemed more aesthetic than real, this one, when taken alone, clearly demonstrates its advantages beyond reasonable question.

In 1886, by personal inquiry and correspondence, I succeeded in collecting the history of three hundred and six cases of tracheotomy performed in Chicago, showing a total of fifty-six recoveries, or 18.95 per cent, and at the same time I was able to report eighty-three cases of intubation (see *Chicago Medical Journal and Examiner*, Vol. LIII, No. 2), also performed in Chicago, with twenty-three recoveries, or 27.71 per cent. That the comparison may be a fair one, embracing about the same number of cases of each operation, let us add Dr. O'Dwyer's one hundred tabulated cases to the one hundred and fifty reported by myself, making a total of two hundred and fifty cases, with sixty-eight recoveries, or 27.20 per cent, a result not far different.

In Meigs' and Pepper's Treatise on Diseases of Children, we find the following: "Jacobi states that out of 1,024 operations of tracheotomy, performed

in various parts of the world, but principally in Europe, 220, or 21.48 per cent recovered."

The most recent and most favorable report on tracheotomy, including a large number of cases, was made by Dr. Max J. Stern, of Philadelphia, at the recent meeting of the International Medical Congress. His statistics, taken from Bourdillat, gave recoveries amounting to 26.40 per cent, the per centage at different ages being as follows:

Under 2 years .....	3	per cent.
Between 2 and 2½ years.....	12	"
" 2½ and 3½ " .....	17	"
" 3½ and 4½ " .....	30	"
" 4½ and 5½ " .....	35	"
Over 5½ years .....	39½	"

It has been my pleasure to collect 1,072 cases of intubation, performed in various part of the United States, with 287 recoveries, or 26.77 per cent. In 661 cases, the ages were recorded, and were as follows:

31 patients under 1 year of age, with 5 recoveries or 16.12 per cent.	661	181	Average, 27.38
97     "     "     1     "     "     15     "     " 15.46     "			
149     "     "     2     "     "     29     "     " 19.46     "			
140     "     "     3     "     "     42     "     " 30.00     "			
98     "     "     4     "     "     32     "     " 32.65     "			
56     "     "     5     "     "     19     "     " 33.92     "			
27     "     "     6     "     "     10     "     " 37.03     "			
32     "     "     7     "     "     16     "     " 50.00     "			
12     "     "     8     "     "     5     "     " 41.66     "			
10     "     "     9     "     "     5     "     " 50.00     "			
2     "     "     10     "     "     1     "     " 50.00     "			
5     "     "     11     "     "     2     "     " 40.00     "			
2     "     "     14     "     "     0     "     " 00.00     "			
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It must be remembered that Dr. Stern's statistics of tracheotomy were derived from *published* reports, which usually present an operation in its most favorable light, while my statistics of intubation have been obtained almost entirely by private inquiry and by letters. Many of the reports included here were too unfavorable for publication, and would otherwise never have been included in the statistics of the operation.

Taking Dr. Stern's statistics of tracheotomy as correct, let us compare them with the statistics of intubation:

AGE.	TRACHEOTOMY. PER CENT.	AGE.	INTUBATION. PER CENT.
Under 2 years.....	3	Under two years.....	15.62
Between 2 and 2½ years..	12	Between 2 and 3 years ..	19.46
" 2½ and 3½ "	.17	" 3 and 4 "	.30.00
" 3½ and 4½ "	.30	" 4 and 5 "	.32.65
" 4½ and 5½ "	.35	" 5 and 6 "	.33.92
Over 5½ years .....	39½	Over 6 years.....	43.33

It is remarkable that an operation which even now is in its incipiency should rival the old and well tried operation of tracheotomy. As it becomes further developed we may expect more brilliant results, and it is safe to predict that it will be the future operation for the relief of membranous stenosis of the larynx.

## INDEX.

Adams, Charles .....	65
Atomizer, hand.....	51
Atomizer, steam.....	56
Appleby .....	61
Abel, J. F.....	77
Babcock, Elmer E.....	53, 88
Berry, J. G.....	65, 68, 75, 78, 79, 83, 85
Bronchocele.....	99
Behrendt, A.....	60, 66, 76
Bosworth, O. W.....	61
Bogue, R. G.....	71
Burbank, H. E.....	72
Bacon, J. V.....	72
Bates, H. O.....	77, 78
Barlow, L. A.....	15, 77
Bert, E.....	77, 81
Banga, H.....	78
Burr, A. H.....	78, 83
Burry, J.....	80
Browne, Sir Lennox .....	83, 84
Boas .....	90
Bouchut, E.....	13, 14, 15
Cartilage, Thyroid.....	29, 30
"    Cricoid .....	29, 30
"    Cuneiform .....	29, 30
"    Arytenoid.....	29, 30, 33, 40
"    Cornicula Laryngis .....	29, 30
Clark, D. S.....	48, 61
Casselberry, W. E.....	60, 61

Caldwell, C. E. .... 65, 62, 64, 67, 77  
Clendening, J. W. .... 69, 71  
Collins, D. .... 70  
Cook .... 85  
Casely, W. I. .... 86  
Church, N. H. .... 87  
Chicago Medical Journal and Examiner. .... 104  
Dessault .... 13  
DeWolf, J. E. .... 82  
Dietrich, H. J. .... 90  
Dahlberg, A. .... 64, 61, 62, 87  
Dyas, G. K. .... 64, 85  
Dal, J. W. .... 74  
Earl, C. W. .... 76  
Epiglottis .... 29, 38  
    " Artificial .... 23, 24  
Extractor .... 18, 20, 35  
Emrick, G. M. .... 74  
Fenger, C. .... 67  
Foster, B. D. .... 92  
Gray .... 8  
Gag .... 17, 21  
Glottis .... 32  
Goodall, W. W. .... 71  
Gatchell, C. .... 79, 88  
Gfroerer, G. S. .... 89  
Hollister, J. H. .... 71  
Hale, E. M. .... 82  
Hoadley .... 65  
Holman, E. E. .... 84, 92  
Hatfield, M. P. .... 60, 61  
Holroyd, E. E. .... 84, 62  
Hall, Wm. E. .... 66  
Introducer .... 18, 35, 37  
Jacobi .... 104  
Jacobs, Jr., T. K. .... 83

Jacques, W. K..... 89  
Jones, Geo. W..... 81  
Johnson, H. A..... 70, 71  
Kauffmann, J. S..... 76, 81, 91  
Kewley, J. R..... 82  
Kossakowski, M. P..... 61, 83  
Kippax, J. R..... 63  
Kimball, F. H..... 64  
Keeler, H..... 81  
Larynx, Anatomy of..... 28  
    " During Deglutition..... 30  
Labarriere, P. C..... 82  
Lawless, J..... 68, 69  
Lackner, E..... 76  
Larkin, J. J..... 78  
Leavitt, S..... 80, 81  
Larrabee, I. A..... 81  
Mackenzie, Sir Morell..... 8  
McWilliams, S. A..... 20, 59, 61  
Merkle, H..... 88  
McCarthy, W..... 85  
Meigs and Pepper..... 104  
Medical Record..... 93  
McGinnis..... 65  
Mannheimer, M..... 70, 71, 81  
McDavitt..... 73  
Mitchell, J. S..... 79, 88  
Murdock, E. P..... 80  
Marr, W. L..... 81  
Macdonald, P..... 71, 80  
Mulfinger, J. L..... 77  
New York Medical Journal..... 93  
Nelson, D. T..... 61, 87  
ODwyer, ..... 5, 15, 16, 17, 18, 19, 20, 21, 26, 43, 93, 104  
Obturator ..... 17, 37  
Oliver, W. W..... 76

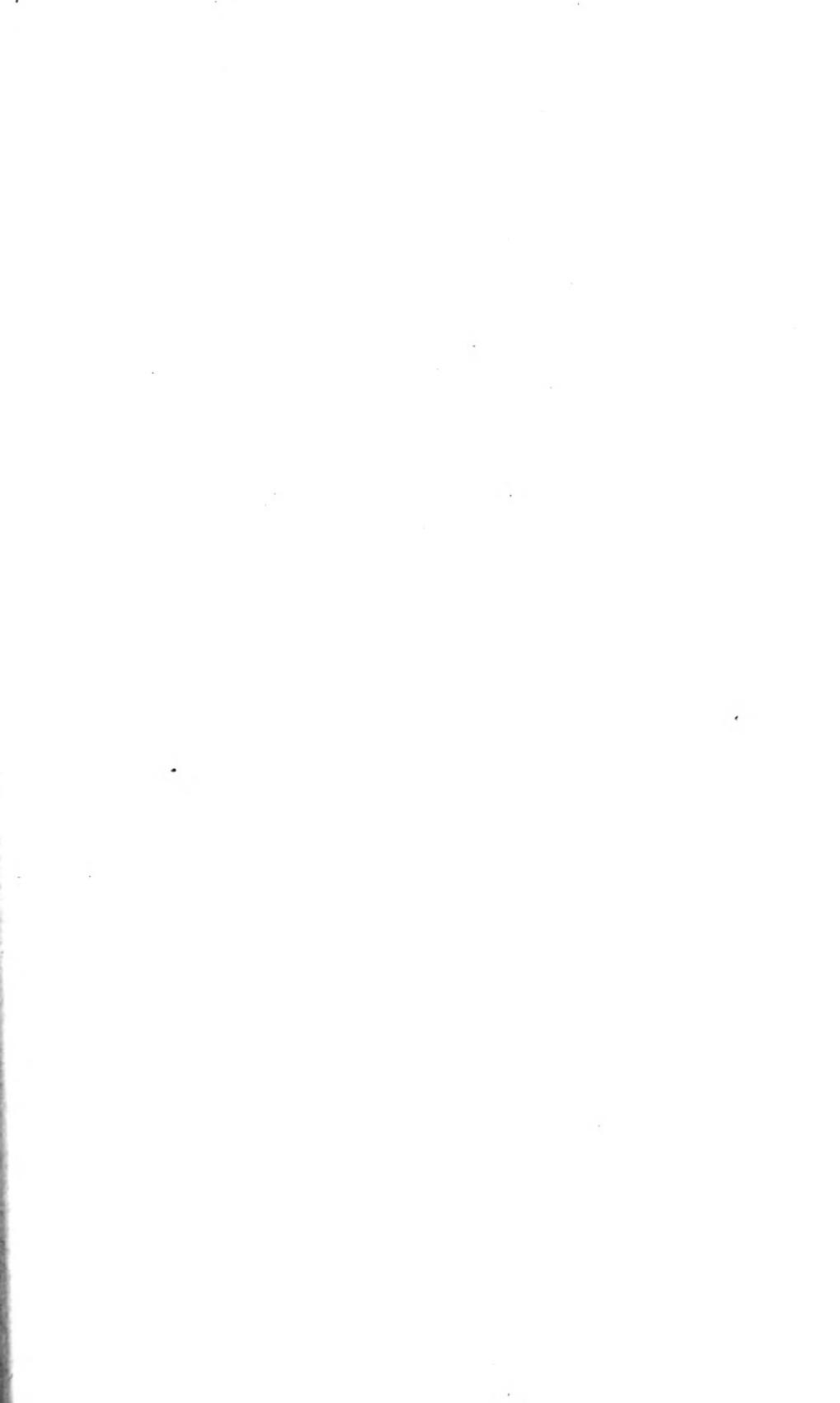
Price, O. J. .... 83  
Pierpont. .... 63  
Parsons, W. .... 67, 91  
Quine, Wm. E. .... 63, 79, 90  
Respirator .... 27, 47  
Roberts .... 91  
Roler, E. O. F. .... 91  
Richardson, J. P. .... 60  
Rea, R. L. .... 66, 91  
Reilley, J. .... 75, 88  
Roy, W. C. .... 76  
Steele, D. A. K. .... 59, 60, 65, 69, 74 75, 83, 88  
Storck, C. .... 67  
Shepherd .... 71  
Steurnagle. .... 73, 82  
Smith .... 84  
Sajous. .... 8  
Sanders, H. B. .... 87  
Skyles .... 89  
Stern, M. J. .... 105, 106  
Trosseau .... 14  
Tracheotomy .... 16, 102  
Trachea, Forceps. .... 27, 45  
Tillotson, G. K. .... 68, 70  
Thomas, A. L. .... 72, 88  
Tallman, E. D. .... 74, 75  
Vocal Cords, true. .... 32  
    “ “ false .... 32  
Valin, H. D. .... 61  
Van Doozer, B. R. .... 67  
Whitman .... 92  
Webb, F. R. .... 76  
Willard, G. E. .... 63











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